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Manager and Secretary: E. S. MIDDLETON.

OFFICE: 4, LUDGATE HILL, LONDON, E.C.4.

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The Standardisation of Voltage.

IN a recent issue (November 4th) we drew attention to the importance of seizing an opportunity, such as that afforded by a change of frequency, to change the supply voltage of an undertaking to the chosen standard pressure of 230 volts; but that is by no means the only opportunity that offers for making a step in the direction of uniformity. Wherever new transformers are to be installed, on undertakings of normal frequency, they should be specified to be suitable for the standard pressure, although at the time some other declared pressure is in force; and when a new district is to be supplied with electricity by an existing a.c. undertaking, there is no valid reason for adopting any other than the standard voltage in that area, no matter what the declared pressure of the parent system may be. Similar cases arise in connection with the electrical equipment of large stores, hotels, &c., which are to be supplied through high-pressure feeders, with transformers installed on the premises; these installations are entirely disconnected from any other part of the distributing system, and it would be to the advantage of the consumers in question to place them on the standard voltage from the very beginning. Every new job which is needlessly carried out at a non-standard voltage helps to prolong the duration and increase the disadvantages of non-uniform pressure.

Again, it has been suggested that in the case of d.c. undertakings, the pressure can be raised or lowered, as the case may be, in stages. For example, on a 200-volt system it is already lawful to supply at 208 volts, and on a 250-volt system, at 240 volts; no great inconvenience would result from the adoption, after due notice, of 210 and 240 volts as the declared pressures in such cases. Most of the existing lamps, radiators, &c., could be continued in use, and motors could be adapted without much trouble—consumers would certainly suffer far less expense and annoyance than if the change to 230 volts were made in one step. After a period of, say, two years, a further step could be made in the same way, with the result that in a few years' time the desired end would be achieved with the least possible

disturbance. Meters could be adjusted, if necessary, by changing gear wheels, or a percentage adjustment of the accounts could be made. Where a.c. extensions are being added to existing d.c. systems, the case for the immediate adoption of the standard pressure in the new areas is still stronger.

There is no need for new statutory powers to carry out the changes here advocated; the Minister of Transport, acting on the advice of the Electricity Commissioners, can authorise them under existing conditions. Those who will invariably raise objections to innovations will doubtless see lions in the path, as usual; but we commend the subject to the serious consideration of managers of supply undertakings who realise the handicap that is imposed upon manufacturers and consumers by the existing variety of voltages, and who have at heart the interests of the whole community.

The Testing of E.h.p. Cables.

WE publish to-day an article in which Mr. M. Höchstadter, the inventor of the H-type cable, and Dr. E. Bowden, a British cable-maker, jointly set forth their considered opinions with regard to the best method for testing cables intended to work at 33,000 volts. In the valuable paper which he read before the British Association (ELEC. REV., September 16th, 1927, p. 479), Mr. P. Dunsheath dealt at some length with this subject, which is admittedly one of the most important questions that the cable industry is engaged upon to-day. So long as cable pressures were limited to 25,000 volts or less, it was possible for the mains engineer to bury his cables and dismiss them from his thoughts; but the new conditions which are met with above 30,000 volts have changed all that, and he has had to acquire fresh experience, often at a heavy cost.

The more accurately the qualities of a cable can be ascertained and its reliability ensured by factory tests, the better for all concerned. The views expressed in the article referred to will command attention, and will repay perusal by our readers, for whose comments our "Correspondence" columns are open.

London's Electricity Supply.

IN the minutes of the London County Council there recently appeared a report (dated November 1st) of the Special Committee on London Electricity Supply, with regard to the sliding scale of prices and dividends which is to apply to the 14 London companies under the two London Electricity Acts of 1925. Before the scale could come into operation, schedules of the companies' assets and statements of value had to be furnished to the London and Home Counties Joint Electricity Authority and approved thereby; until the Authority was in a position to deal with this matter, the County Council carried on the negotiations, and the statements of all the companies except one—the Charing Cross Co.—had been approved of as amended. Standard prices were tentatively fixed in December, 1925, by all the London companies, as bases for negotiation, and eight of the ten "West End" companies have agreed with the Council's accountant as to the costs and charges to be allowed for in the standard prices; but separate prices have to be fixed for different classes of consumers—namely: traction, bulk supply, street lighting, and private consumers—and Mr. J. H. Rider, M.I.E.E., has been commissioned to report to the Council on this matter. Certain points of difference between the Council and two companies—Charing Cross and London Electric Supply Corporation—remain to be settled; some of these have to be decided by the Electricity Commissioners, others by arbitration, and the Committee recommended that it should be authorised to take the necessary steps for the latter purpose.

Whilst we recognise that the County Council has done its best throughout the long negotiations of the past three years to expedite the final settlement of the complicated questions that have arisen, we cannot regard with complacency the slow progress of the work. The standard prices, when at last fixed, will only operate till the end of 1931, and we are well on the way to that date already. Moreover, it is to be feared that when all is done, the prospect of a material reduction in the tariffs offered by the company undertakings in London will not be rosy; the limitation to a dividend of 7 per cent. looks well on paper, but as that percentage is to be paid on capital enormously swollen by the capitalisation of the "free reserves," the actual rate paid on the capital expended may be something like twice as much in some cases. That great reductions could be made without detriment to the interests of the shareholders if the companies adopted a forward policy and offered attractive terms to domestic consumers, shopkeepers, and the like, can hardly be doubted, in view of the excellent results shown by the municipal undertakings, but some of the companies seem to be quite content with things as they are. The City Company has set a good example by charging for heating with low-temperature convectors 1d. per kWh by day and ½d. by night; obviously this tariff opens the way to thermal storage water heating at night, which was fully discussed in a recent article in our pages by Mr. L. G. A. Sims. There is no technical obstacle to the adoption of the same policy by other undertakings, seeing that it does not necessitate any increase of plant or mains, and would materially improve the load factor.

The Christmas Boost.

WE hope that electrical trade readers have their plans for National Electric Week practically completed. Only the last finishing touches should now remain. Our next issue will be dated December 2nd, and as the great effort is timed to start off on Saturday, December 3rd, it will be useless to urge the trade to get on with the planning of programmes then. So we must here and now get our last word out to electrical contractors, shopkeepers, showroom managers and staffs, and everybody likely to be able to influence the purchasing public.

During National Electric Week (December 3rd to 10th) and for a fortnight thereafter the public will be spending a great deal of money on presents. Can anybody guess the value of the turnover?—it ought to be very much larger than it has ever been before owing to the variety and suitability of electrical articles, and every year has brought a growth in the electrical habit. A week or two of strong electrical window displays, an abundance of electrical advertising in every shape and form, and alertness and enthusiasm on the part of every salesman, cannot fail, as E.D.A. suggests, to give a considerable impetus to the Electric Present vogue. We shall be glad if readers will report to us on the effect upon their businesses of this Christmas boost.

It is encouraging to learn that about 550 electricity supply undertakings and contracting firms have ordered the special window display which was illustrated in our issue of November 11th. This effective setting for electrical appliances should do much to stimulate sales. A goodly proportion of the undertakings have also promised to do additional advertising during the Week. It is to be hoped that other supply authorities will follow the lead of those pioneers who have promised free electricity for the E.D.A. window fit-up, realising that they, as well as the contractors, will benefit from sales of apparatus.

E.D.A. has addressed an "Open Letter" to "everyone engaged in any section or grade of electrical work" explaining what the Electric Week means to the Electric Worker, and urging each to do a little to help the movement. All are asked to talk to somebody during the Week about the *advantages* of electricity, and those who have special publicity and window display facilities are urged to do their utmost to create such an atmosphere that it will be easier than ever before to sell electricity and electrical appliances. It is hoped that everybody electrical will set a good example by buying at least one electrical present.

Automatic Telephony in London.

A general description of the new Holborn public exchange, the first to be inaugurated in the complex metropolitan area.

THE second stage of the introduction of automatic telephony into the Greater London area was completed at midnight on November 12th, when the dream of Almon B. Strowger became a reality to nearly 10,000 of London's half million subscribers. Introduced some 25 years ago, over 3.5 million telephones are now operated on the Strowger principle throughout the world, but it was the development of the "director register controller" that hastened the solution of London's complex traffic problem.

The Holborn automatic exchange is housed in the same building as the mechanical "tandem" equipment,* with which it will be so intimately associated until the whole of the Greater London area has been equipped for automatic working. To serve the 9,400 subscribers for which the Holborn exchange is at present equipped, there are 222 director register controllers, or roughly, one to every 42 subscribers connected, and traffic records indicate that this proportion will suffice. Subscribers "dial" seven digits, comprising three letters (representing the initial letters of the name of the exchange to which the wanted number is connected), followed by four numerals (representing the actual number in that exchange). The "director" register controller: (1) receives and stores the call; (2) translates the three code (letter) impulses, in order that the call may be directed over the best available route; (3) transmits, first, the translated code impulses and, secondly, the four numerical impulses. It will therefore be realised that the routing of calls is not directly effected by the trains of impulses corresponding to the three letters as dialled; the "director" translates the first trains of impulses into a particular form, which depends upon the number of selectors, and their various levels, over which the call has to be "routed." The translated trains transmitted by the "director" are entirely different from the impulses corresponding to the code letters; thus, the dialled impulses 236 for CEN (CENtral) may become another series altogether, up to six digits, as sent out by the "director" to actuate the routing selectors which extend the connection to the desired exchange. Dialling the first letter operates a selector (digit switch) that seeks an idle "director," which then receives on its "BC switch" the second and third letters dialled, the impulses sent out being translated in accordance with a predetermined plan, but the numerical part of the call is retransmitted in the same form as received.

So soon as the last numerical digit has been dialled and its train of impulses has passed through the sequence of switches constituting the "director," the latter, as a complete unit, immediately becomes available for another call, and is selected in its turn by the next subscriber requiring its temporary services. To ensure constant supervision, there is incorporated an automatic "routiner," which systematically, and of its own volition, subjects each "director" in turn to an exhaustive series of tests, representing more drastic conditions than obtain in normal service; any abnormal condition is thereby detected before it has time to prejudiciously affect the service. This equipment, which is set in action by the simple closing of a switch, effects obvious economies in maintenance *personnel;* any "director" found to require attention can be temporarily cut out of service, or "busied," by throwing over an individual switch without affecting the traffic passing at the time.

Another feature is the 80 coders which convert the dialled trains of impulses received from automatic subscribers into appropriate codes of impulses to operate the coder call-indicators at the outlying manual exchanges, where the connections are completed by the local

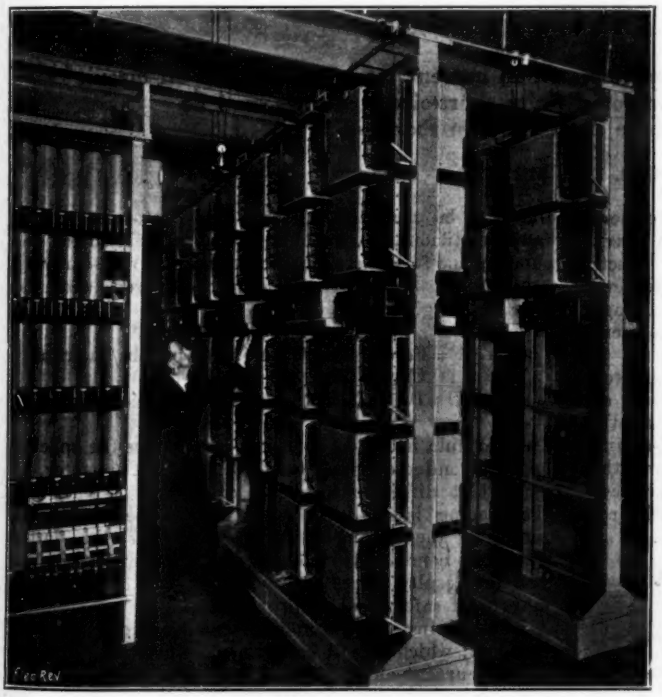


Fig. 1.—"Director" Register Controllers.

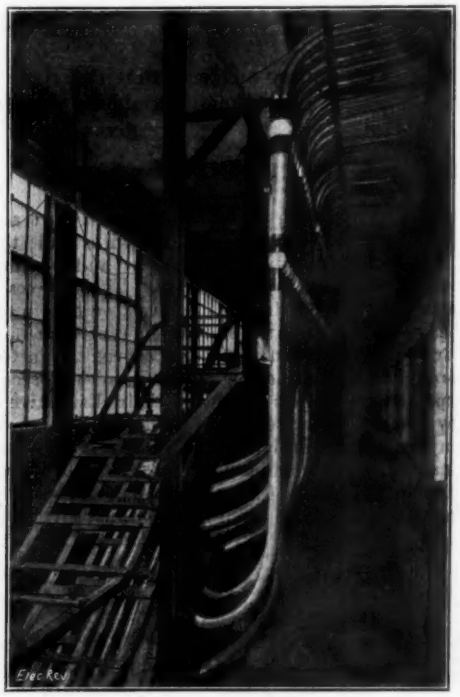


Fig. 2.—Cables Entering Exchange from Subway.

* ELEC. REV., October 7th, 1927.

telephonists. They are analogous to the "senders" in the "tandem" exchange. Conversely, for handling manual-exchange traffic incoming, 31 cordless, or semi-"B," switchboard sections are arranged in suites, each telephonist's position being equipped with a row of ten keys numbered 0 to 9, resembling those of a typewriter, and also lettered similarly to the dials on the automatic telephones.

In addition, there is a manual switchboard of specially equipped "A" positions for telephonists who handle calls for call boxes, give information, answer inquiries, investigate complaints concerning the service, and divert official calls into their proper channels.

For operating both the automatic and tandem exchanges, power plant has been installed in the basement of a total output of 300 h.p. There are duplicate sets of 25-cell Chloride batteries, each of 10,000-Ah capacity, the weight of each individual cell being of the order of two tons. The charging sets comprise two 150-b.h.p. directly-coupled motor generators, by Newton Bros., Derby, arranged for working off the 200-volt d.c. supply. One of the ringing machines is driven off the 200-volt supply, and is normally in service, the second machine deriving its energy from the battery; the output of each is 4 amperes at 75 volts, the standard frequency being 16.6 cycles per second. No less than eight square inches of solid copper constitutes the cross-sectional area of the main bus-bars, each battery being protected by an overload circuit breaker. The peak load on the exchange reaches 1,500 amperes at 50 volts, a record having regard to the fact that it is a purely telephonic load, and includes no lighting or power requirements in the exchange premises.

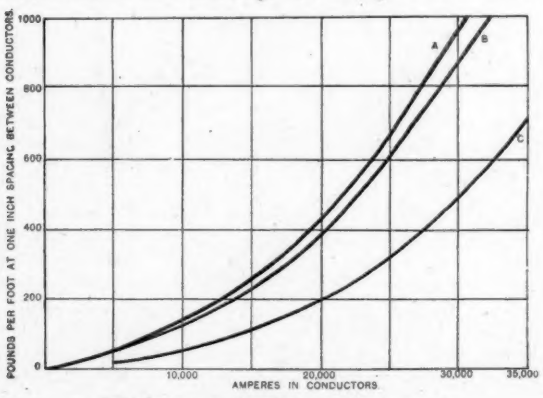
The whole of the Strowger and "director" equipment at Holborn was manufactured and installed to the order of the British Post Office by the Automatic Telephone Manufacturing Co., Ltd.

Short-Circuit Effects upon Current Transformers.

The author suggests that the time has come when current transformers, like oil circuit breakers, should be designed for definite short-circuit ratings, and he gives below some suggestions to that end.

By G. L. E. METZ.

IN common with all switchgear, current transformers have to be designed to withstand the heavy mechanical distorting forces and heating effects caused by large fault loadings. These forces are very severe on large systems, and have been known to damage heavy apparatus and destroy current transformers entirely. The destruction of a current transformer is brought about either by the mechanical forces exerted upon the windings exceeding their disruptive limit, or by the temperature rising sufficiently to permanently injure the insulation. The design of the supporting insulators and clamps must be such as to withstand the mechanical forces. That they assume considerable magnitude can be seen from fig. 1, which gives the electro-



A=single-phase; B=three-phase; C=direct current.

Fig. 1.—Mechanical Forces between Conductors.

magnetic loading per foot run for current-carrying conductors spaced one in. apart. As the force varies inversely with the distance between the conductors its magnitude can be easily arrived at for any required spacing. The curves A, B, and C are for single-phase, three-phase, and d.c., respectively, where the conductors are spaced in the same plane. They are really prepared to give the magnetic loading upon bus-bars and connections, but they serve to illustrate the mechanical forces likely to be met with in current transformers under fault conditions. A formula which can be used for calculating the force between two parallel current-carrying conductors, whose length is large compared with the spacing, is given below:—

$$F = 9\ I^2/(D \times 10^8)$$

where F = Force on each conductor per lb./in. run.
I = Current in amperes.
D = Distance between centres of conductors in inches.

This formula is correct for those cases where the spacing between conductors is at least 10 times the diameter, or equivalent dimensions, of the conductor. When the the spacing is small compared with the section of the conductor the arrangement and shape of the latter come into consideration, but if the equation is applied and the result increased by 25 per cent., an ample margin of safety will be provided.

By applying the formula for the transformer shown in fig. 2, which it will be assumed is carrying a short-circuit current of 30,000 A, the force exerted upon the

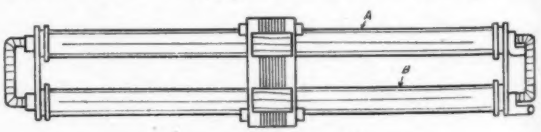


Fig. 2.—Current Transformer.

supporting insulators A and B will be calculated to be of the order of 12 lb. per in. run. The stress will be applied suddenly and resemble a hammer blow.

Where bakelised-paper insulators are used they will accommodate themselves to the elastic limit of the copper winding; but porcelain has practically no yield point, and will therefore relieve the windings of the repulsive load up to the breaking limit of the insulating material. This is one of the disadvantages of porcelain insulators, but the results of tests taken by many leading manufacturers have shown that whether in tension, compression, or both, porcelain can be used quite satisfactorily, providing its safe strength (allowing a fair margin of safety) is not exceeded.

As general figures, the safe strength of porcelain may be taken as: compression, 40,000 lb. per sq. in.; and tension, 1,500 lb. per sq. in. It will be seen that the mechanical forces set up under short-circuit conditions are very severe and must be given special attention when the current transformer has to operate upon a system of large plant capacity.

The thermal effects of the fault current are also very important; they limit the cross-sections of the primary and secondary conductors to definite minimum values, which, in turn, has a very large bearing upon the size and design of the transformer.

The appreciation of the fact that a current transformer which may be quite satisfactory for use upon a system of small plant capacity would be quite inadequate upon a system of large plant capacity is important. Modern tendencies appear to be toward the erection of large capital generating stations, and the interconnection of existing systems and plant capacities of 300,000 kVA will be by no means unusual in the future. It would be commercially and practically unsound to design all current transformers to withstand the thermal and mechanical effects which would be met with upon systems of such large plant capacity. This policy, although desirable in some respects, would suffer the great disadvantage of costly and unwieldy transformers being installed upon the smaller systems. In the opinion of the writer the time has arrived when current transformers, like oil circuit breakers, should be designed with a certain short-circuit rating, and with this end in view attention is drawn to the table given below, which connects the minimum sizes of primary conductors necessary for various short-circuit capacities:—

Rupturing capacity of breaker at B.E.S.A. rating.	Maximum short-circuit current at 6,600 V (peak value).	1-second rating, 60% peak value.	5-second rating, 40% peak value.	Minimum area of conductor in sq. inch.		
				½ sec.	1 sec.	5 sec.
K.V.A.	A.	A.	A.			
30,000	4,400	2,640	1,760	.037	.031	.046
50,000	7,300	4,400	2,940	.061	.052	.077
75,000	11,000	6,600	4,400	.091	.077	.115
100,000	14,700	8,800	5,870	.123	.104	.154
150,000	22,000	13,200	8,800	.183	.155	.231
250,000	36,600	22,000	14,600	.305	.258	.385
500,000	73,000	44,000	29,400	.610	.520	.772
750,000	110,000	66,000	44,000	.915	.772	1.15

The current and sectional area are inversely proportional to the pressure, and can therefore be easily obtained from the above table. The short-circuit and not the plant capacity of the system has been taken, as it is felt that a useful check can be obtained by comparing the short-circuit rating of a current transformer with the rupturing capacity of the oil circuit breaker located nearest to it. In the majority of cases current transformers are connected in circuit sufficiently close to a circuit breaker to suggest this check as being of general application.

The temperature reached by the current-transformer windings under momentary short-circuit conditions depends on its thermal capacity and not upon its radiating qualities. The permissible temperature rise under these conditions is limited by the possibilities of fusing the windings and destroying by burning the main and subsidiary insulation between the turns. With high temperatures of the order of from 200 to 300 deg. C., insulating materials appear to give off inflammable gases, thereby very greatly increasing the possibility of general ignition, and this fact must be kept in mind. It has been found that a momentary temperature of 120 deg. C. under short-circuit conditions can be allowed on most current transformers without the risk of permanent injury to the insulation between the turns. This allows a temperature rise of 90 deg. C. above an ambient temperature of 30 deg. C.; if this figure is exceeded the solder will melt and permanent damage will be done to the insulation.

It is possible to calculate the size of conductor necessary for a given temperature rise, assuming there are no losses by radiation, and so on, from the formula given below:—

$$A = \sqrt{.24\ I^2\ R t / T\ s_1\ s_2}$$

where A = Section of conductor in sq. cm.
I = Current in amperes.
t = Duration of fault in seconds.
R = Specific resistance of conductors.
T = Temperature rise in deg. C.
s_1 = Specific heat.
s_2 = Specific gravity.

If a temperature rise of 90 deg. C. is adopted, this formula becomes, for copper:—

$$A = (I/10^4)\sqrt{.57t}.$$

By means of this formula the current densities for copper conductors at various time ratings have been calculated as follows:—½-sec. rating, 120,000 A. per sq. in.; 1-sec. rating, 85,000 A. per sq. in.; 2-sec. rating, 60,000 A. per sq. in.; and 5-sec. rating, 38,000 A. per sq. in. The density loadings are higher in most cases than the fusing currents of the windings, so that if they are maintained in excess of the time ratings given, final fusing of the windings is certain to occur. The short-circuit current should be calculated in the manner employed for oil circuit breakers, and advantage of the fall in value from a high initial current to a lower sustained-fault value should be taken. When calculating the short-circuit current for oil breakers it is usual to adopt the short-circuit decrement curve assumed in the B.E.S.A. specification No. 116, which is for a modern alternator having a 10 per cent. reactance. This curve is given in fig. 3; it will be seen that the average values of the short-circuit currents for comparatively long periods, such as five seconds, are

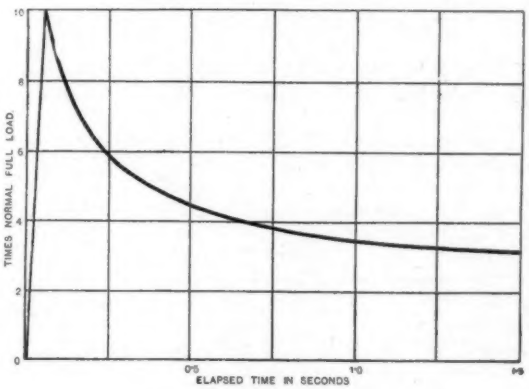


Fig. 3.—Short-circuit Decrement Curve.

very much less than the instantaneous values. It is, therefore, suggested that for the half-, one-, and five-second ratings the equivalent steady currents to give the same heating effects might be taken as 100, 60, and 40 per cent. respectively. The current density and required sectional area of the primary winding can also be determined in this manner. It is not necessary to have the sectional area of the primary and secondary windings proportional in the inverse ratio to the turns in order to obtain a short-circuit current density of 120,000 A per sq. in. in both windings. The secondary current under short-circuit conditions is determined not so much by the value of the current in the primary winding as by the value of the secondary induced e.m.f. and the impedance of the secondary winding.

In the majority of modern designs it will be found that under the most severe conditions, *i.e.*, when the magnetic core is saturated, the open-circuit secondary induced e.m.f. rarely exceeds 400 volts. The total resistance of the circuit will be about 2 ohms, so that under no condition is the secondary current likely to exceed about 200 amperes. With a short-circuit current density of 120,000 amperes per sq. in. this would require a section of 0.0016 sq. in. for the secondary conductor, corresponding to a gauge of wire far too small to carry the normal full-load current of 5 am-

peres. No difficulty is encountered in this respect, therefore, with the secondary winding. The choice of time ratings depends upon the fault protection provided on the system; if instantaneous operation is provided, the half-second rating is applicable, the longer ratings being used only when time delays are employed.

On systems of very large plant capacity the pressure will most probably be much greater than 6,600 volts, with a consequent reduction of the sectional area of the conductor, so that it is apparent that if a current transformer is required to operate upon a system of very large plant capacity and withstand the consequent heavy short-circuit effects, it must be of very special design. It is possible that under certain circumstances it would be advisable to sacrifice the technical efficiency for commercial considerations and replace the current transformer after a fault had occurred of sufficient severity to permanently damage it. This practice has been adopted at times with oil breakers, but, generally speaking, such large fault-currents are only encountered upon very large systems, and then at points of the system where reliability is at a premium.

33,000-volt Cable Testing.

A review of present-day h.p. cable testing practice and a suggested specification of factory and installation tests embodying a combination of the usual methods.

By M. HÖCHSTADTER and E. BOWDEN, D.Sc.

EVER since the introduction of cables for pressures above 25,000 volts, there have been considerable differences of opinion amongst cable engineers as to the tests which should be applied to the cables, but it is generally agreed that no tests so far devised can be relied upon to ensure that the cables will give satisfactory service under operating conditions.

In the following, the development of the various methods of testing is briefly reviewed, and a specification of tests proposed which appears to the writers to meet all the necessary requirements so far as present knowledge and experience go.

In the early days, following the practice for l.p. cables, great importance was attached to the instantaneous breakdown test, but it was soon found that this test alone was of little value, since cables which passed it easily did not always stand up under working conditions.

The ionisation test was then introduced (see Dutch rules), the value of which was at first rather over-rated, but it was later realised that a combination of the breakdown and ionisation tests made for greater security.

The next stage in the development of the methods of testing was the introduction of the so-called time-voltage characteristic. It was thought that by means of this test it would be easy to estimate the probable life of the cable and determine the permissible voltage gradient in the insulation. This method is undoubtedly a very useful one by which to judge the quality of a cable, but unfortunately it is impracticable for routine testing purposes on account of the large number of tests and the long time required.

In Holland the stability test was introduced some years ago for 10,000-volt cables, but it did not meet with general appreciation. The reason for this was partly that the test seemed to be unnecessary for 10,000-volt cables, but principally because it was too complicated. The main objection to it as a test is that it is based on the ionisation point, which in many cases it is impossible to determine accurately.

In England the importance of the absolute value of the dielectric losses was rather over-estimated at first, and a great deal of attention was given to the power factor-temperature characteristic. This characteristic was generally held to be of the utmost importance, while the power factor-voltage characteristic, which was subsequently recognised to be of much greater value, was almost entirely neglected. It is now generally agreed that the latter characteristic is of great importance as indicating to what extent ionisation will occur in the cable, while a comparison of the characteristics before and after the cable has undergone one or more heat cycles will show to what extent it will remain stable under operating conditions.

Experience has shown that each of the above methods, or a combination of some of them, may be satisfactory for cables up to 25,000 volts, but for cables above this pressure no specification of tests has yet been devised which is satisfactory both to the buyer and the manufacturer. What is required is a specification by which tests made under ordinary factory conditions will ensure complete security, not only in the factory, but also later in service.

The following specification is based upon a large amount of experience abroad and a certain amount in this country. It is considered that the conditions are wide enough to be met by all manufacturers with modern plant and reasonable care in design and manufacture, and at the same time strict enough to safeguard the interests of the buyer in his endeavour to obtain a cable which can be relied upon to give satisfactory service.

Factory Tests.

Dielectric Resistance.—The insulation resistance shall be measured after one minute's electrification with d.c. at a pressure between 100 and 1,000 volts. The insulation resistance measured in this manner, and corrected to a temperature of 15.6 deg. C. (60 deg. F.), shall be between 180 and 750 megohms per mile. The co-efficient for the correction of the dielectric resistance to the standard temperature shall be supplied by the manufacturer.

Pressure Test.—Every drum of cable shall be subjected to a pressure of twice the actual working pressure for 30 minutes, followed immediately by three times the actual working pressure for 3 minutes. "Actual working pressure" is the pressure maintained between two conductors, or between one conductor and the lead sheath, under service conditions.

Capacity. — The electrostatic capacity shall be measured in the usual manner.

Dielectric Loss (Power Factor).—The power factor of each drum length shall be measured as a function of the pressure, the tests being carried out at a constant temperature not less than 10 deg. C. and not more than 35 deg. C. The method used shall preferably be the "Schering bridge," or a similar rapid method of allowing the power factor to be read directly and independently of the wave form of the power supply. The power factor shall be measured at the following single-phase pressures, *viz.*, 10,000, 20,000, 30,000, and 40,000 volts, or the corresponding three-phase pressures. On single-core and type-"H" cables the test pressure shall be applied to each conductor separately against the lead sheath: on the belted type of cable the measurement shall be made by the application of three-phase pressure. The results so obtained shall be recorded graphically. The curves obtained in this way,

on each drum length, shall satisfy the following conditions:—

At any point the value shall not be higher than 0.015; the slope of the curve shall not be greater than to give an increase of 25 per cent. between the value at 10,000 volts and the value at 40,000 volts single-phase pressure; and between any two consecutive points there shall not be a greater difference than 15 per cent. of the value of the power factor at the point corresponding to the lower pressure.

Breakdown Test.—A sample of the cable about five yards long shall be cut at the direction of the purchaser from one of the drum lengths. If the order covers more than three miles, a similar sample shall be taken from each three miles, or part of three miles, of the total order. These samples shall be tested as follows:—An initial pressure of twice the actual working pressure shall be applied for five minutes, after which the pressure shall be raised in steps of the working pressure every five minutes. The sample of cable shall not break down before a pressure equal to six times the actual working pressure has been reached. If a breakdown occurs outside the lead sheath it shall not be considered as a breakdown, and the test shall be repeated after the broken-down end has been cut off and a new end made, provided that the net length of cable covered by lead is not less than three yards.

Bending Test.—A sample of cable five yards long shall be taken at the purchaser's direction from each three miles, or part thereof, and shall be subjected to the following test:—At a temperature not less than 10 deg. C., nor greater than 20 deg. C., the test piece shall be bent round a drum of a diameter equal to twelve times the diameter of the cable over lead sheath, three times in one direction, alternating with three times in the opposite direction. The test piece shall then be subjected to the breakdown test specified above, and it shall not break down before a pressure of five times the actual working pressure has been reached.

Stability Test.—This test shall be made on a full-drum length to be selected by the purchaser. If the order comprises more than three miles, the purchaser may select for test one drum length from each three miles or part thereof. The power factor-voltage curve at normal room temperature shall be taken in the same way as already indicated, the ambient temperature and conductor resistance of the cable being observed after due precautions have been taken to ensure that the cable in all its parts is at the ambient temperature. The cable shall then be heated from the ambient temperature to 50 degrees C. The heating may be carried out by passing current through the conductor, or in a heating chamber, or by both means combined.

When a stable temperature (measured by the conductor resistance) has been reached, the power factor-voltage curve at 50 deg. C. shall be observed and plotted, and this curve shall satisfy the conditions specified for the dielectric loss-power factor test.

After the cable has completely cooled down to the initial temperature, the power factor-voltage curve at this temperature shall again be observed, and shall satisfy the same conditions as before. The values so obtained shall be identical with, or shall not differ by more than 10 per cent. from, the values obtained before heating for the same pressures. If in one or more points the curves before and after heating differ by more than 10 per cent., the purchaser may require this test to be repeated, and no point of the power factor-voltage curve obtained after the second cooling shall differ by more than 10 per cent. from the corresponding value of the initial curve before the first heating.

Note.—It is essential that the points compared shall relate to exactly equal temperature, as sometimes a difference of temperature of only 1 deg. C. may produce an appreciable difference in the corresponding power-factor value.

Installation Tests.

Pressure Test.—After the cable has been laid and all joints and terminal boxes made, it shall be subjected to an alternating-current pressure of twice the actual working pressure for 30 minutes, or a continuous-current pressure of five times the actual working pressure for 15 minutes.

Dielectric Resistance.—The dielectric resistance shall be measured after laying, as in the first clause above. The insulation resistance shall not be less than 100 megohms per mile.

Current Rating Test.—After complete installation, tests shall be made by passing the normal-load current through the cable and measuring the temperature rise by the variation of conductor resistance to establish that the manufacturer's guarantee as to the current-carrying capacity of the cable has been met.

Joint Boxes and Terminal Boxes.—If the contract includes the supply of joint boxes and terminal boxes, one joint box and one terminal box shall be made in the factory and shall be subjected to the pressure test specified for the cable itself.

Note.—In the above tests care shall be taken that the wave form of the testing supply shall be as nearly as possible sinusoidal.

Lessons from America.

The author discusses the effect of high wages, low production costs, and the development of the home market, and reviews the subject of industrial relations, emphasising the importance of works committees.

By J. W. THOMAS, LL.B., B.Sc., A.M.I.E.E.

THERE have been many studies of American industrial conditions published recently in this country, some of them rather superficial, but all written with the object of describing and accounting for the boundless prosperity which America is at present enjoying. Some of the investigators, as a result of their visit, have become hot gospellers of American methods and have confidently assured us that if only our industrialists would learn her secrets and copy her methods a new era of economic and commercial prosperity would dawn. These travellers' tales have naturally awakened a good deal of interest and not a little scepticism.

A brief survey of the salient features of American industry and the conclusions which have been drawn during these recent visits will not be without interest to engineers, particularly as some of the investigators have themselves been connected with engineering and have given special attention to the conditions in the engineering industry. Such a survey will help us, on the one hand, to decide whether any of the methods which America has successfully employed can be adopted with advantage in this country, and will prevent us, on the other, from jumping to the conclusion that in order to recover our prosperity all we need to-day is to imitate her methods or adopt some particular feature of the American system, such as high wages or the open shop.

Of the many reports which have been issued, there are three which, in the writer's opinion, deserve the most careful consideration, *viz.*: (1) The report of the delegation appointed by the Minister of Labour;

(2) the report of Mr. Butler, Deputy Director of the International Labour Office; and (3) the account given by Mr. Ramsay Muir in his book, entitled "America the Golden."

The visit of the delegation appointed by the Minister of Labour and that of Mr. Butler were official, whilst that of Mr. Ramsay Muir was quite unofficial. Their conclusions, however, are surprisingly similar and their accounts are characterised by soberness of statement, intelligence of observation and keenness of perception both of the bright and dark spots in American conditions.

In regard to the main features of America's phenomenal prosperity there is general agreement; in fact, practically all the observers who have given an account of their visit are unanimous in their verdict that the prosperity is real and incontestable, that there are abundant evidences of general well-being and that there is a buoyant confidence amongst all classes which is sadly lacking in this country. America has achieved for the bulk of its inhabitants a standard of life higher than the mass of people enjoy anywhere else in the world. Though higher wages are not necessarily evenly distributed, the average wage level is certainly much higher than has been attained in any other industrial country. Except for a short set-back which occurred in 1924, the United States has enjoyed this high degree of prosperity since 1922. It manifests itself not only in an improved standard of life amongst the working people, but by the increases in the deposits of savings banks and in business profits and general savings. The prosperity is so marked that the elements which have contributed to achieve it cannot be a matter of indifference to any other industrial country, and the question naturally arises as to what are the causes underlying it and whether those causes can be made to operate in England.

Mr. Ramsay Muir warns us at the outset that whilst there may be a good deal to be learnt from America, we cannot afford to disregard the profound differences which exist between it and this country. These are so great as to make any argument from one country to the other extremely precarious. There are conditions over there which are not only incomparable with anything that we have here, but cannot possibly be reproduced in this country.

In the first place, America is by far the richest country in the world in undeveloped and usable natural resources. It is abundantly rich in almost every product of the earth, with perhaps the exception of rubber. It is thus not dependent on other countries to anything like the same extent as England, which has to look abroad for most of its raw material, with the exception of coal.

Secondly, the United States forms the largest free trade area in the world; in fact, it constitutes not a country but a continent. Being practically self-sufficient, America can therefore afford to enclose itself within its tariff wall and can rely upon the huge home market for the sale of its manufactures. Moreover, being able to produce most of the things it requires, it does not suffer from the exclusion of either raw material or manufactured goods as is the case with this country. These enormous advantages of ample natural resources and a huge home market were immensely accentuated by the war, which enabled America to devote itself to manufacture, whilst the European nations were in conflict, and to gain a predominance in certain new industries which it has never lost.

Again, labour conditions are profoundly different. The demand for labour in America for some time exceeded the supply, and this tended to force wages up and to keep them up. The obvious result was that employers were compelled to cast about for other methods of cheapening production, and they consequently turned their energies to the development of the greater use of machinery so as to get the most out of their labour power. This relative scarcity of labour has been maintained of late years by the Immigration Laws.

It is apparent that we cannot reproduce these conditions to any appreciable extent in this country, as they are largely beyond our control. We cannot, for instance, augment our exploitable resources, though we may make better use of them. Nor can we compel Continental countries to remove their tariff barriers and so widen our market. And we certainly cannot hope to see the demand for labour exceed the supply.

There are, however, other factors at work in America, and which to some extent account for its prosperity, which we might be able to reproduce here. The one which has captured the minds of some of the investigators and of which they have become the enthusiastic exponents, is what has now become known as the policy of high wages. The realisation on the part of the American business men that the high wages which they were forced to pay at first on account of the scarcity of labour meant high spending power, and therefore increased consumption, has brought about an enormous change in their outlook. Many of them have now adopted the view that the secret of prosperity is to pay the highest practicable wages, to produce goods at the lowest practicable prices, and to trust to a huge turnover for their sales. This belief certainly seems to have been justified by the results, though whether it will stand the strain of a prolonged period of bad trade remains to be seen.

The principal exponent of this gospel is, of course, Mr. Ford. With him the test of the efficiency of a firm is the level of wages it can afford to pay. But if high wages have proved to be economically advantageous in America, does it follow that the same would occur here? One must admit that experience seems to be on the side of America's industrialists. High wages have meant high consumption, and have forced employers to make more use of up-to-date machinery. It is not therefore unreasonable to assume that similar action in this country might produce similar results, though perhaps in a lesser degree. Instead of adopting this method, however, our industrialists have gone to the other extreme, and have regarded the cutting down of wages as the panacea for their industrial troubles, with the result that the home market has shrunk and the demand for their goods has diminished. If experience in this country has taught anything, it has shown that low wages have not brought about any increase in prosperity; in fact, probably the reverse.

Another of America's characteristics, which it is claimed might be imitated, is in regard to the wholesale application of mass production methods. This has been possible in such industries as the automobile industry, where a high degree of standardisation has been achieved. Business is organised in big units which are able to specialise on certain products and standardise their methods. This renders possible the production of greater quantities, a greater subdivision of processes, and a more intensive use of machinery.

The question arises as to whether we in this country can adopt American methods of mass production. The answer is certainly in the affirmative, and there are some British manufacturers of motor-cars who are showing what can be done to-day in that direction. It is customary, however, for some people to argue that we cannot imitate America's mass production methods on the same scale because we do not possess America's home market. It is contended that America is fortunate in having a home market which makes the potential demand very great. To this one may reply that this immense market is largely the outcome of the extended purchasing power of the American working classes. Evidently therefore the market is not merely dependent upon the size of the territory, though admittedly this is an important factor, but it is also dependent on the purchasing power of the people. The purchasing power for manufactured articles is dependent upon there being a margin left in the wages of the people after the necessities of life have been provided for. In other words, it depends upon high wages. We are thus brought back to the connection between high wages and mass production, and manufacturers in this country can hardly hope to follow the American example in mass production unless

they are prepared to follow it in wages. Here, as in America, the probable key to prosperity lies in a deliberate policy of developing the home market, and to effect this high wages would seem to be indispensable. Unless purchasing power grows, increased production is impossible, and it is in this connection that America affords us a lesson on which we should do well to ponder.

America is ahead of us in the strong belief its industrialists possess in the value of scientific research and in the facilities which they have provided. No important undertaking is without its laboratory, and the investigations carried out are not confined merely to the improvement of scientific processes, but cover such questions as to how human effort can be economised and work made not only more productive but also more healthy and interesting for the worker. Even the Trade Unions devote part of their funds to research, and in some cases they have retained competent engineers to advise them as to the best means of organising the workshops and skilled accountants to report on the conditions of firms with which they are in relation. This is another feature which it is within the power of employers and Trade Unions in this country to copy.

Added to these advantages there are greater facilities for higher education than exist in this country.

Another interesting feature is the wide diffusion of industrial shareholding among the upper strata of the working classes. The expansion of saving and investment amongst the mass of the people has been astonishingly fast of late years, with the result that property, and in particular ownership of shares in industrial capital, is distributed more widely to-day than ever before. The change is so striking that it is widely acclaimed as a social portent of the highest significance, and as being the true alternative to the public ownership of capital inasmuch as it helps to establish a real community of interest between labour and capital, and to abolish the cleavage between those who work and those who own, by making the two identical.

This increase in popular investment has been due to the deliberate policy pursued by the large firms on the one hand and by Trade Unions on the other. The motive of the employers is obvious enough; they want to avert industrial unrest by making their workers feel concern for the maintenance of dividends as well as of wages.

The system is not without its critics, who contend that the wholesale enrolment of workers as industrial shareholders weakens their negotiating power, and is also injurious to them, as it induces them to put all their eggs in one basket. When a big concern fails, the employés not only lose their jobs, but also their savings. This danger is recognised, and to avoid it some firms discourage their employés from investing in the firm in which they are employed.

But for English observers the most striking fact about industry in the United States is the new outlook in regard to industrial relations. America is the land of experiments, and in no department do there appear to be so many as in this. Attempts are being made to elevate the study of the relations between employers and employés to the dignity of a science, and there is a growing realisation that it is in this field that the greatest strides can be made. Not only is this new outlook manifested by the managements, but also by the men. On both sides there is a keenness to welcome co-operation, and a conviction is springing up that the old tradition of armed watchfulness varied by open war does not afford the best means of advancing the interests of labour, as it is hostile to production, and therefore decreases the amount of wealth from which labour can claim its share. There is a determination to drop the attitude of enmity which hitherto has been maintained towards management, and to offer in its place active and practical co-operation to secure greater efficiency and larger output. There is, moreover, a decided move in the direction of closer contact in the workshop between management and workpeople, so as to deal on each individual firm with its own peculiar difficulties while providing for the common rules of each industry to be settled by other means.

It is in the insistence on the necessity of beginning at the right end, *viz.*, in the workshop, that the American method differs from that in this country. The principle which underlies it was tersely expressed in the report issued in 1920 of a conference representative of employers, unions and the public, which was called by President Wilson in 1919, "The guiding thought of this conference has been that the right relationship between employer and employé can be best promoted by the deliberate organisation of that relationship. That organisation should begin within the plant itself." This report greatly influenced the policy of the employers. It is claimed that industrial problems vary not only in each industry but in each establishment; therefore the strategic point to begin battle with misunderstandings is within the firm itself. Industrial peace must have its foundation in confidence and goodwill in the workshop. In general, the object of employé representation is to establish an organisation within the industrial firm by means of which grievances can be remedied promptly and on the spot, suggestions for improved industrial relations and conditions can be considered, and general efficiency promoted within the establishment. This organisation takes the form of a Works Committee, sometimes with an impartial chairman from outside, which can deal with the settlement of disputes or grievances, including unfair dismissals, and enable the union representatives to consult freely with the management on the means of obtaining maximum efficiency. In most cases wages and hours are not dealt with by the organisation set up, but are considered under a separate scheme or are determined by individual arrangement. Such an organisation forms a genuine system of joint control, which helps and strengthens management without invading its legitimate sphere. In some works where these joint bodies exist they have been set up wholly apart from Trade Unions, for the majority of American employers still refuse to recognise trade unionism. But in other works they are directly based on collaboration between unions and management. In fact, the first important experiment, that of the Baltimore and Ohio Railway, was definitely launched on Trade Union initiative, and has throughout been conducted on the basis of full Trade Union recognition. It was largely because of the success of this scheme that the idea spread to other firms. There is no doubt that where an opportunity for representation and self-expression has been given to the workpeople it has reduced strife and made for harmonious and prompt settlements of grievances, whilst providing opportunity for discussing in a business-like way the problems that arise between management and employés.

One is inclined to think that it is in regard to employé representation in the workshop that we can learn a most useful lesson from America. So far the Whitley Councils in this country have been chiefly based on the districts with a national organisation at the top, and they have become almost exclusively instruments for ordinary collective bargaining about wages, hours and cognate questions. This, of course, is not what they were intended to be by the framers of the Whitley Report, who stressed the need for collaboration in making production efficient. If the success of employé representation in America is any criterion, it would seem that the Whitley scheme in this country began at the wrong end. It concentrated its aims on the national and district bodies, and left the Works Committees to look after themselves. Thus it did not provide for that direct contact been management and men which is the outstanding merit of the American scheme which began at the other end, *viz.*, the workshop. It must not be supposed, however, that the American scheme was necessarily the outcome of the farsightedness of the employers: it arose rather from the practical conditions which existed and the state of Trade Union organisation. Many employers were so anxious to preserve the open shop that they adopted a plan which gave their employés a voice in industrial affairs without the need of them

being enrolled in a union. Some have even used the plan as the weapon with which to fight the unions, and it may be pointed out that this is a danger to which any similar scheme is always exposed. But notwithstanding this, experience has proved that the scheme has considerable merits, and the fact that it is being run in many firms with the support and approval of the unions shows that it has real attractions.

The question therefore arises whether it would not pay to introduce it here. One thing is certain; if it is to develop in this country and to produce beneficial effects on production and in industrial relations, it must be based on the fullest recognition of the Trade Unions, otherwise it will be met with suspicion and hostility all along the line. The time would seem to be ripe for some form of shop co-operation which allows the worker a share in the control of the industrial concern in which he is engaged, without depriving him of the protection of his union.

One of the certain effects of closer co-operation between employers and employés will be a demand for greater publicity in industry. Here, again, we have a great deal to learn from America. Employers over there pool their information and give particulars about costs, prices, production, and other matters to their Associations with the utmost freedom. This is in striking contrast with what obtains in this country, where there is a secrecy and reserve which prevent the knowledge gained by various firms being used for the benefit of all. There is still an idea prevalent in this country that success is fostered by preventing one's rival from knowing what one is doing. American employers have found that what loss there may be in imparting information is more than compensated for by the knowledge that is gained.

In conclusion, the frequent utterances which have been made recently in this country on the subject of industrial peace are a clear indication that there is a growing realisation, both amongst employers and employés, that the traditional policies and methods in industry are no longer effective, and that they must be remoulded in order to deal with the changing conditions which have arisen. New ways and means of industrial organisation are imperative if productive efficiency is to be increased; whilst we need to avoid any slavish imitation of American methods, it is unquestionable that a study of her industrial conditions will give food for thought, and may help toward finding a solution of our own difficult problem of industrial relations.

Electric Ploughing.

A method has been adopted in Italy of suspending the electric power supply cable by means of a balloon.

By R. BORLASE MATTHEWS, Wh.Ex., A.M.Inst.C.E., M.I.E.E., F.R.Ae.S.

A CONSIDERABLE amount of interest, both in engineering and agricultural circles, is bound to be aroused by the appearance on the market of an electric tractor plough with its supply cable suspended in the air by means of a balloon, instead of being dragged over the ground in the usual way. This equipment was designed and tested recently in Italy, and British patents have already been granted for it.

One of the most difficult problems in connection with an electric tractor-plough is to devise a satisfactory method of dealing with the flexible cable connecting the tractor to the point of supply. The all-important factor is to ensure that the cable is not dragged over the ground, for, apart from the extra power required due to friction, there will be excessive wear on the cable.

One or two methods of dealing with this problem of cable wear and tear due to dragging have been evolved. The modern way is to mount the feed cable reel on the tractor itself; thus the cable can be paid out and allowed to rest on the soil, instead of being dragged after the tractor. Then, on the return journey, it can be picked up and wound on the drum as the tractor retraces its path.

In the Forssblad tractor plough (designed in Sweden) the cable drum is operated by a small motor, through a friction drive, the motor being provided with a special hysteresis control rheostat, so that when the tractor is driven away from the source of supply the cable is drawn out against the friction drive, without any danger of burning out the winding motor, though the current is left on the latter all the time, even when the drum is stationary. When the tractor returns, the cable is slackened; then, as the resistance to the winding motor is thus removed, it automatically comes into operation and winds the cable up to a predetermined tension. Even this scheme, however, causes a certain amount of whipping and dragging of the cable over the land. A further improved method of dealing with the cable is that employed on the McDowall plough, which was described in the ELECTRICAL REVIEW of July 2nd, 1926; thereby the dragging about of the cable is eliminated, though, of course, there is the wear due to its being continually picked up and laid down again.

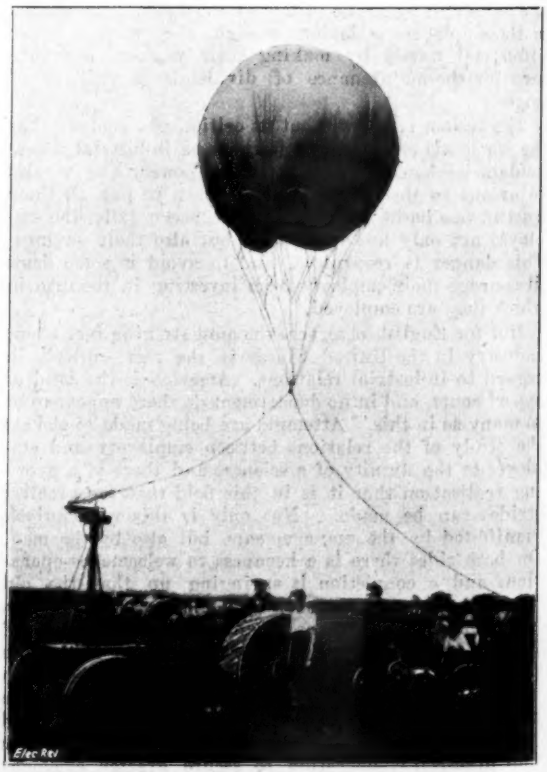


Fig. 1.—Balloon-suspended Power Supply Cable.

While both of these methods have proved satisfactory, there can be no doubt that the scheme adopted on the

Italian plough is even more ingenious. In this case, the cable is suspended in the air from a balloon. In the experiments already conducted in Northern Italy, the tractor was equipped with a 25-h.p., 230-volt, three-phase electric motor, but no cable drum was mounted on the tractor. The cables used were 0.0145 sq. in. (10 sq. mm.) insulated aluminium, and the length of cable raised from the ground was about 110 yards. The diameter of the balloon was 17 feet, and its net lifting force 110 lb. The tractor travelled at a speed of two and a quarter miles per hour and ploughed to a depth of from twelve to eighteen inches. No difficulty was experienced with the balloon; in fact, it was found that considerably more work could be accomplished than had been anticipated, as the balloon permitted the tractor more scope for manœuvring around. The method of operation is as follows:—

An insulated cable runs from a transformer cabin to a movable post fixed in a convenient position in the field. From this post a cable is run to a mast on the tractor. At the top of the post there is a revolving brush contact which allows the cable to turn round the post without becoming tangled or twisted. A similar revolving brush contact is placed at the top of the mast on the tractor. Of course, if the ploughing were carried out on the figure-of-eight system, *i.e.*, if the turns at each end of the furrow were made in opposite directions, there would be no need for these revolving contacts. The balloon is fixed on the cable halfway between the post and the tractor. As a precaution, a steel safety cable is also attached to the balloon. The height of the balloon depends upon the position of the tractor. As the tractor approaches the cable post the balloon rises, and when the tractor moves away the balloon decends. Literally, the portion of the cable not required is hung out of the way, up in the air. The tractor is free to move in any direction, the limiting distance being controlled only by the length of the cable. This distance can, of course, be varied by lengthening or shortening the cable, the only requirement being that care must be taken to see that the dimensions of the balloon are such as to allow for the maximum weight of cable required.

The balloons used are very easily handled. The one employed for the original experiments was controlled by one or two men without any difficulty. They can also be attached to a motor lorry for transport on the road. The shape of the balloon shown in the illustration is spherical, but for larger sizes it is proposed to utilise an elliptical shape, in order to reduce the stress on the cable from wind pressure.

An important feature of the design is that a circular area, with a radius equal to the length of cable, can be ploughed without moving the fixed cable post.

The success of the system will depend in a large measure on the class and size of cable used, because the cost of the balloon will be governed by the weight of the cable to be lifted. It is proposed to fit an automatic discharge valve on the balloon, which, in the event of the cable breaking, will open and permit the gas to escape, thus preventing the balloon from being blown away.

In Sweden, bare aluminium alloy strip has been employed for electric tractor feed. In this case, the feeder was kept suspended taut in the air by an automatically turned tensioning drum. The feeder consisted of three flat strips of the aluminium alloy placed side by side. The strips were kept separated by means of presspahn slips, which were riveted across at suitable intervals. This form of feeder would be ideal for suspension from a balloon, as its weight is the minimum.

It is very refreshing to come across a radically new development in the ancient art of agriculture, such as this novel idea of supporting in the air what would otherwise be a trailing cable, by means of a balloon. Naturally there would be certain difficulties in operation, as for example, in windy weather. Further, the farmer would have to learn a new trade, in handling a small balloon; but this is a fairly simple matter.

Correspondence.

Correspondents should forward their communications as early as possible. *No letter can be published unless we have the writer's name and address in our possession.*

Overhead (132,000-Volt) Lines' Supposed Danger.

It has been stated in the columns of the *Daily Mail* (October 17th) and *Electricity* (November 11th) that " . . . it is seriously argued that live cables at night will engender a sort of luminous corona effect which will prove an excellent guide to enemy aircraft in time of war. . . ." To avoid the talked-of danger spreading, it would seem necessary to explain the why and how of this phenomenon, and at what voltage it occurs. Electricity supply undertakings could not possibly produce and deliver cheap power over long-distance overhead lines that " glowed with a bright light at night "; the overhead lines referred to will not give off the slightest hissing sound (one of the characteristics of corona), far less the appearance of a glow, and not a sign of localised glow at the insulator.

A simple explanation of this phenomenon is as follows: when the voltage between conductors in air is raised to such a value that the dielectric strength of the surrounding air is exceeded, corona occurs, due to the ionisation of the air, and the voltage at which this phenomenon first occurs corresponds to the disruptive critical voltage; a voltage higher than this virtual voltage is the visual voltage referred to. A small change in voltage above the disruptive critical voltage makes a large percentage change in the loss of power—in practice the object of the engineer is to design and construct for an operating voltage below the disruptive critical value. The values of virtual and visual voltages vary with climatic conditions (dry, clear, fog, smoke, rain, sleet, snow, &c.), dimensions and roughness and separation of the conductors (cables), frequency, air density, &c. For maximum economy, overhead transmission lines are operated at an average voltage around 90 per cent. of the disruptive critical voltage for the conductor (cable) used—along this same reasoning we may say that, for a given cable, the line losses in the transmission of a given load are a minimum when the line voltage is of the highest practical value.

With respect to the 132,000-volt overhead lines for the South-East England area, the conductors (cables) are to be stranded, 0.77 inch in diameter, and have a separation between any two conductors not less than 144 inches. Therefore, the lines can be operated up to 170,000 volts, or slightly higher, in fair weather without any formation of corona about the conductors, and for the worst possible weather conditions and highest altitude to be crossed, the loss of power from this cause will not be of any practical or economic value, *i.e.*, practically nil.

As the *national* system (called " grid ") is for the unification and interconnection of all selected authorised undertakings throughout the United Kingdom, the writer firmly maintains that the adoption of 150,000 volts normal minimum transmission voltage would be better and more economical for the diameter of cable chosen—time will tell.

William T. Taylor.

London, *November 18th*, 1927.

Overhead Line Costs.

In reply to the letter of Mr. J. A. Morton that appeared in your issue of November 11th, regarding my article on sectional " Armoured Concrete Poles " on September 23rd and my letter of November 4th, I should like to point out that the object of many of my remarks was to stress the technically excessive cost of rural lines at home, thanks to the regulations and obstructive conditions which exist. The reply of Mr. Morton, perhaps on his part unwittingly, confirms this view; for example, why should a No. 8 copper wire in England require a maximum sag of 16 feet under the regulations, while in France a fraction of that figure suffices?

I admit that for some classes of outdoor work paid spectators seem to be required at times; but, assuming that Mr. Morton's calculations and premises are correct, then at 1¼d. (his figure) per hour it would take well over 300 men-hours to erect and tie in 12 spans of No. 8 wire with three conductors, although each wire weighs only about 22 lb. per span.

I have some figures regarding quantities of material and hours of labour required to make sectional concrete posts in France; provided unskilled labour is allowed to do unskilled work and an Englishman is graciously allowed to do as good an hour's work as a Frenchman, the cost should be reasonable.

Regarding earth wires, I should think that something like 90 per cent. of the rural lines in the world are put up without them, although the skies do not fall in consequence.

One way towards a solution is to do what the ELECTRICAL REVIEW has been doing, namely, to spread information on the subject; another is to support the Overhead Lines Association which, unlike the Government, is out to encourage discussion, not to blanket it.

In view of the shower of technical and statistical " inexactitudes " with which the country was drenched last year, it is not astonishing that some people view with scepticism particulars of what is going on abroad, but if those in authority

in official and commercial circles went abroad more often to find out what is being done, how it is being done, and why it can be done, we should be in a better position to pull up level agriculturally with some of those countries which supply us with so much farm produce to-day. **Theodore Rich.**

Woldingham, Surrey, *November 16th*, 1927.

[Space considerations compelled us to shorten this letter. —EDS. ELEC. REV.]

Overhead Line Regulations.

In answer to his inquiry under the above heading in your issue of November 11th, I would inform "Bilaw" that the main road crossing referred to on the Preston-Blackpool overhead line, presumably that at Freckleton Road, has been erected entirely in accordance with the regulations prescribed by the Electricity Commissioners, Form El.C.39.

The regulation governing road crossings reads as follows:—"(2) In the case of a line erected across a public road, canal or railway there shall be provided (*a*) duplicate insulators for supporting the line conductor and a device to ensure that in the event of a line conductor falling it shall be put to earth; or . . . . . ."

Evidently "Bilaw" did not observe the bridling of the conductors, the duplicate insulators, and the earth bar fitted below each conductor, which arrangement fully satisfies the regulation quoted above. **E. O. Stewart,**

Resident Engineer, CALLENDER'S CABLE & CONSTRUCTION CO., LTD.

Preston, *November 16th*, 1927.

The Cost of Electricity.

I read with interest the contribution of Mr. R. A. Williams in your issue of November 11th, and noted that he considers the cost of electricity in this country a great deterrent to its use and to the sale of appliances. Let me quote my humble experience:—A year ago I bought a pre-war-built house in a village twelve miles from London. Electricity had been brought to the village about six months previously by an electricity company. Its charges are 8d. per kWh for lighting and 2½d. for heating and cooking, plus a meter rental. I wired the house for lighting only, as 2½d. for heating is absurd. I previously lived in a suburb where there was a municipal supply, and paid 4½d. for lighting and 1d. for heating, with free mains and no meter rent. Then I used a 2-kW fire and a small cooker. When I moved, I had to dispose of my heaters, as 5d. per hour to warm a chilly room is out of all reason. I am using a vacuum cleaner and an iron off the lighting circuit, but that is expensive, as all washing is done at home. Very few old houses in the village have been wired, and not all the new ones, owing to the cost of bringing the mains in, and the subsequent cost of energy; they still rely on an antiquated gas service.

The district is a growing one; there is an enormous film studio, which must have a very large consumption, and another is about to be built. The supply company has erected a very nice showroom, but it does seem a pity to me that the benefits of electricity should be so restricted by its high price.

R. G. Fletcher.

November 16th, 1927.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

The E.D.A. Circle Campaign.

The Electrical Development Association has produced an "open letter" for distribution to the staff and employés of all branches of the electrical industry. This letter, designed particularly for the National Electric Week, stresses the importance of everybody in the industry doing his or her share in promoting its success. A number of interesting points are put forward, including the suggestion that every employé should buy at least one electrical Christmas gift.

Over 550 supply undertakings and contracting firms have now ordered the special window display for National Electric Week and 110 Circles and undertakings have promised to carry out additional advertising. A poster for vans bearing the slogan "For Health's Sake Use Electricity" has been produced by the E.D.A., as well as a handsome slide for kinema and theatre advertising. The total number of demonstration houses and exhibitions has reached 64, and the formation of a new Circle at Bridlington brings the total number of Circles to 103. On the lecture panel 82 towns are represented by 177 speakers. The Association suggests the running of "window-spotting" competitions in showrooms and windows.

Electrical Christmas Gifts.

We recently received from the GENERAL ELECTRIC CO., LTD., some suggestions for Christmas presents in the shape of domestic appliances—fires, kettles, irons, &c.—and radio apparatus.

The BRITISH THOMSON-HOUSTON CO., LTD., is also early in this field, and makes a special feature of its portable electric lamps, arranged to hang upon the backs of chairs or the headrail of a bed, and table lamps.

Messrs. A. H. HUNT, LTD., Croydon, have sent us a number of pamphlets illustrating and describing articles which they consider suitable Christmas gifts. These include pocket lamps, cycle-lighting outfits, radio measuring instruments, h.t. and l.t. batteries, &c.

Electrical appliances are attractive and useful gifts; one point which may be emphasised is that their prices do not go up for the Christmas season as is the case with a good many other lines.

A "Television" Disclaimer.

During the hearing of the petition of Marconi's Wireless Telegraph, Ltd., for the confirmation of its capital reduction, it was implied that the Baird Television Development Co. was a subsidiary of the Marconi Co. Mr. O. G. Hutchinson, joint managing director of the Television Co., has written to the Press to contradict this. He says that there is no connection whatever between the two concerns. The statement regarding the payment made to Mr. Baird for his invention was without foundation. As a matter of fact, Mr. Hutchinson states, the patents were sold to a company known as "Television, Ltd.," and Mr. Baird received only a small cash payment and certain shares in the company.

Armistice Day Celebrations.

One way in which London commemorated Armistice Day was by a community-singing festival in Hyde Park, which attracted a vast crowd of people. The band of the Irish Guards provided the music, and the electric lighting of the band, conductor's platform, and the public enclosure was effected by means of G.E.C. "Wembley" lanterns equipped with 1,500-W gasfilled lamps. These were mounted on 25-ft. masts spaced at intervals of 90 ft. The work was carried out by Messrs. Barlow Bros. & Co., Oxford Street, W.

Unemployment.

There was a further increase (5,640) in the number of unemployed during the week ended November 7th. The total at that date was 1,111,700, as compared with 1,106,060 on October 31st, and with 1,562,959 on November 8th, 1926.

Australia's Foreign Imports.

The Commonwealth Government, alarmed at the increasing proportion of foreign imports, is (according to the Sydney correspondent of the *Daily Telegraph*) conducting an examination as to how far a substantial increase in the margin between British and foreign rates of duty will check the present tendency. After quoting representative figures of foreign imports, including £2,960,000 worth of electrical machinery, the correspondent says:—"It is clear that the existing tariff preference is not preventing this large volume of trade from foreign countries being done in Australia, and therefore more effective steps are necessary if the desire to promote a larger measure of trade within the Empire is to be realised."

Brazilian Railway Electrification.

The Times Trade and Engineering Supplement states that a project for the electrification of railways in the vicinity of Rio de Janeiro is again before the Brazilian Congress. It is provided that the work shall be carried out by the railway administration itself, and tenders will be called for the necessary supplies of materials, *viz.*:—Metal work, electrical apparatus, transformer stations, &c.; transmission lines complete; traction equipment, including locomotives; locomotor wagons exclusively for suburban traffic; other rolling stock according to specification; and an electric power station at Deodoro. In addition, tenders will be invited for the utilisation of the falls of Mambucoba and Salto, both on national property.

Correction.

In the advertisement of the BRUSH ELECTRICAL ENGINEERING CO., LTD., appearing in our last issue (p. 36), an error occurred in the wording under the illustration of the transformers. "500 cycle" should, of course, read "50 cycle."

Employment during October.

The November *Ministry of Labour Gazette* states that although in the engineering industry generally there was little improvement, in the electrical engineering section conditions remained fairly good. The percentages of unemployed for October are calculated on a revised basis, *i.e.*, upon the number of insured in July, 1927. On this basis the overall percentage of unemployed in the engineering industry fell from 9.4 to 9.2. The electrical engineering figure remained stationary at 4.6 per cent. There was an improvement in the electrical wiring and contracting industry, the proportion of unemployed falling from 5.7 to 5.2 per cent. The same occurred in the electric cable, wire and lamp manufacturing group, in which the figure fell from 5.8 to 5.1 per cent. The actual numbers of unemployed on October 24th were as follows:—Engineering (including electrical), 91,776; electrical engineering, 3,628; electrical wiring and contracting, 772; cable, wire and lamp manufacture, 4,291.

Central American Electrical Trade.

A recent Department of Overseas Trade report on Panama and Costa Rica (Stationery Office, 1s. 6d. net) shows that during the year ended June, 1925, electrical machines and apparatus to the value of $156,331 were imported into the Republic of Panama. The bulk of these goods came from the United States and Germany. During 1925 Costa Rica imported electrical goods valued at £48,086.

American Enterprise in Italy.

It is reported from Milan that an American-Italian holding company has been formed with a share capital of $30,000,000 for the acquisition of Italian electrical securities. The undertaking is composed of an American branch with predominant American administration, and an Italian branch with a predominance of Italian administration. At the same time Government measures are announced for the purpose of preventing the majority of the shares in Italian companies from passing into foreign hands.

Local Exhibitions.

DOVERCOURT.—A Health Week Exhibition was held recently at the Drill Hall and the Norwich Municipal Electricity Department (engineer: Mr. E. Jordan) arranged a display. This consisted of a stand arranged as two rooms—a dining room fully equipped with electrical appliances and an all-electric kitchen. In the latter demonstrations of cooking, washing and ironing were given in the afternoon and evening.

WOKING.—At a recent Trades Exhibition held locally the Woking Electric Supply Co., Ltd., arranged the comprehensive display shown in the accompanying illustration. The many domestic functions of electricity—cleaning, washing, cooking,

Electrical Display at Woking.

heating and refrigeration—were represented and, in addition, the company displayed quartz "sun" lamps, and motors for power purposes. The exhibition was attended by about 15,000 people.

BRONDESBURY.—Some weeks ago we described an "all-electric home" opened at their showrooms, High Street, Brondesbury, by Messrs. Watson Marsh & Co. We then mentioned that the leading manufacturers of appliances were taking turns in exhibiting their products. The most recent display was made by the British Thomson-Houston Co., Ltd., and the Hotpoint Electric Appliance Co., Ltd. Special arrangements are being made to secure the attendance of young people, and invitations have been sent to a number of girls' schools.

KENSINGTON.—A display of "Magnet" electric cooking and washing equipment was arranged recently by the General Electric Co., Ltd., at the showrooms of Messrs. Cunningham, Slater, Ltd., High Street, Kensington, W.

HINCKLEY.—An electrical exhibition recently held at Hinckley was organised by the Leicestershire and Warwickshire Electrical Power Co., which, of course, was one of the principal exhibitors. The exhibition was very successful both as regards the local interest created, and the number of inquiries received by local electrical contractors.

A photograph of the stand of the British Thomson-Houston Co., Ltd., is reproduced herewith. One side of the stand was illuminated by means of "Mazda" gasfilled lamps in "X-ray" reflectors, fitted with colour screens, in order to demonstrate good and efficient shop window lighting. The general illumination of the stand was provided by means of a variety of both domestic and industrial lighting fittings. In addition to the units shown in actual use, a number of

The B.T.-H. Stand at Hinckley.

the fittings were also displayed on the counters. Other apparatus shown on the stand were "Tungar" battery chargers, fractional-h.p. motors, and "Hotpoint" heating and cooking apparatus, including electric irons and a ten-gallon wash boiler. The exhibit also included a quantity of radio apparatus.

MYTHOLMROYD.—An exhibition of domestic electrical appliances, organised by the Electrical Distribution of Yorkshire, Ltd., was opened on November 21st, and will continue to December 3rd, at an "all-electric" house at Stocks Garden, Mytholmroyd. Electric cooking and washing demonstrations are being given daily.

Electric Power in Industry.

Preliminary Report No. 27 upon the 1924 Census of Production (*Board of Trade Journal*, November 17th) shows that in the cocoa and sugar confectionery trades there was 8,987 kW of generating plant and 53,866 h.p. of electric motors, power for 39,955 h.p. of which was purchased. Quarries, other than metalliferous and slate quarries, reported 10,321 kW of generating plant (against 683 kW in 1907) and 27,917 h.p. of motors (power for 15,827 h.p. purchased). In the building and contracting trades there was 3,841 kW of generating plant. There was also 103,915 h.p. of electric motors, power for 98,710 h.p. of which was purchased.

Indian Electrical Imports.

The recently-published review of the trade of India in 1926-27 now published by the Government shows that the imports of electrical machinery during the year increased from 222 lakhs of rupees in 1925-26 to 229 lakhs, increases being noticeable in the case of transformers and generating plant. The United Kingdom supplied electrical machinery to the value of 186 lakhs, as compared with 184 lakhs, and the United States 23 lakhs, as against 20 lakhs in the preceding year. The share of Germany also improved, from 9 to 11 lakhs. The imports of electrical instruments and apparatus amounted to 252 lakhs, compared with 225 lakhs. The trade in electrical apparatus is largely British, and British manufacturers are maintaining their lead in the Indian market, notwithstanding competition from the Netherlands and the United States in such lines as electric lamps, batteries, &c. The value of the imports from the United Kingdom increased from 152 lakhs to 170 lakhs, and those from the United States from 23 lakhs to 33 lakhs. The Netherlands improved her trade, mostly in electric lamps, from 8 lakhs to 10 lakhs, while the participation of Germany and Italy remained at 22 lakhs and 7 lakhs, respectively.

The Millionth Valve-Holder.

The BENJAMIN ELECTRIC, LTD., announces that the sales of its valve-holder are nearing the million mark. Accordingly the company has arranged to present inscribed gold watches to the trader who receives the millionth valve-holder and the factor who takes the millionth-and-first.

Marking Imported Wire.

Messrs. W. F. DENNIS & Co. write to point out that the Order-in-Council regarding the marking of imported wire, which was referred to in our last issue, does not stipulate that iron and steel wire shall be marked upon importation, but upon sale or exposure for sale.

Recent Contracts.

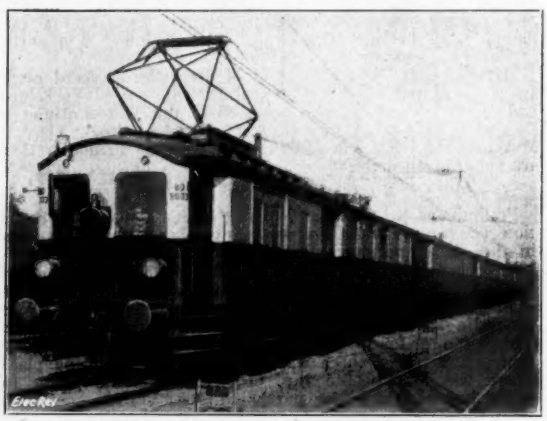
The METROPOLITAN-VICKERS ELECTRICAL CO., LTD., has recently received several important contracts for traction equipment. Included in these are orders for railway equipment for the Sydney (N.S.W.) suburban lines, and the Northern Railway of Spain, and tramway equipment for Glasgow and Sheffield.

A large repeat order has been received from the Sydney suburban railways for motor-coach and trailer-coach equipments, bringing the total of "Metrovick" equipments on this system to more than 350 of each type. The motors, two for each motor-coach, are units of 360 h.p., probably the most powerful individual motors ever installed for multiple unit trains. They are wound for a line pressure of 1,500 V, and each pair is controlled in series-parallel connection. The multiple unit control gear is of the electro-pneumatic type. A further order from the Sydney railways is for more than 100 control equipments for converting non-driving motor-coaches into driving motor-coaches.

Following the order placed last January for 104 motors of 230 h.p. each for the Barcelona-Manresa electrification of the Northern Railway of Spain, a further order has now been placed for similar motors for the 1,500-V electrification of the Irun-Alsasua section. As in the former case, the coaches will be manufactured by the Sociedad Espanola de Construccion Naval, which is associated with the Metropolitan-Vickers Company, at its Bilbao works.

Eighty complete tramcar equipments, together with forty additional controllers, are being supplied to the Glasgow Corporation tramways, to replace equipment, mainly of Metropolitan-Vickers manufacture, which has given reliable service for many years. For the Sheffield Corporation tramways 100 motors have been ordered, together with gears, also supplied by the Metropolitan-Vickers Co. The equipment is similar to 110 sets supplied to Sheffield last year.

For the Dutch railways, a repeat order has been received for 50 motors complete with gears, further control equipments, pantagraphs, and various details. The motors are of 210 h.p. each, for operation at 1,500 V. As four motors are used on each motor-coach, the order comprises ten complete motor-coach equipments and spares. It brings the total of Metropolitan-Vickers equipment for the Dutch railways to nearly 200 motors and gears and complete control equipments for about 50 motor coaches. One of the trains is illustrated herewith.



A Dutch Multiple-unit Train with "M.-V." Equipment.

Messrs. ALFRED HERBERT, LTD., have received an order from the N.V. Provinciale en Gemeentelijke Electriciteits Maatschappij, Amsterdam, for a further four "Atritors" making 16 "Atritors" in use and on order for the Centrale Noord Station at Amsterdam. These machines will each have a pulverising capacity of 8,000 lb. of coal per hour, and will be driven in pairs by steam turbines. This is believed to be the largest single installation of unit pulverisers in Europe.

The Great Yarmouth Corporation has placed an order with the BRUSH ELECTRICAL ENGINEERING CO., LTD., for a 7,500-kW Brush-Ljungström turbo-alternator, complete with condenser and auxiliaries. This will be the third Brush-Ljungström set in this station, the two previous ones being 1,500-kW sets.

CORRECTION.—Under this heading last week reference was made to the "Compagnie Générale des Métaux." The correct name of the company is "Compagnie Française des Métaux."

Aluminium Production in Norway.

The Norsk Aluminium Company has been for some time past testing a new process for manufacturing aluminium, and it is stated that the process has been found successful and advantageous both from a technical and economic point of view. As a consequence the Norwegian company is said to have decided to erect a works at Hoyanger for working the new process, which is stated to be a combination of the electrothermic and chemical methods. The method is claimed to render it possible to manufacture not only aluminium, but also iron of high quality. The Haugvig Smaltverk, which obtains power from the State works at Glomfjord, is reported to have now begun its activity. The undertaking is stated to be a branch of a British company which produces aluminium in England and owns bauxite mines in France. The Haugvig works has 70 furnaces installed and of these 20 have been brought into use. When all the 70 furnaces are in operation the consumption of power will be about 55,000 kilowatts.

New Falk, Stadelmann Showrooms.

Messrs. FALK, STADELMANN & CO., LTD., have recently opened new showrooms at Newcastle-upon-Tyne. Here there is a large display of the company's electrical fittings and accessories, including alabaster and glass bowl fittings, painted glassware and enclosed lighting units. The new showrooms (a section of which is illustrated herewith) are expected to be of considerable service to local dealers.

New Falk, Stadelmann Showrooms at Newcastle.

New Municipal Showrooms.

The Wakefield Corporation electrical engineer has reported in favour of the provision of showrooms for the electricity undertaking.

Trade Announcements.

B.E.N. PATENTS, LTD., 92, Tottenham Court Road, W.1, has been appointed by the U.S. Electric Tool Company as sole concessionaire for the British Isles, for that company's portable electric tools.

The RADIO SERVICE COMPANY has opened premises at 29, Old Town Street, Plymouth.

The address of SPENCER-BONECOURT, LTD., is now Broadway Buildings, Broadway, S.W.1. Telephone: Victoria 2802-3.

Messrs. D. WINTON THORPE, A.M.I.E.E., and C. G. BOSCO, both of whom were, until recently, on the staff of the General Electric Co., Ltd., Magnet House, Kingsway, W.C.2, have resigned their appointments with that company and have formed a company, Thorpe & Bosco, Ltd., to carry on the work of electrical engineers and contractors. Their temporary address is 36, Soho Square, W.1

Mr. GRAHAM, electrician and wireless engineer, has opened new headquarters in Northgate, Blackburn, having taken over the existing business of Mrs. Caton.

Mr. WM. Y. MCADAM, electrician, Hamilton, has opened a branch business at 54, Raploch Street, Larkhall.

New Catalogues and Lists.

THE GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2.—A folder containing illustrations in colour of eight models of "Gecophone" loud speakers of the horn and cone types. Priced.

MESSRS. S. G. BROWN, LTD., North Acton, W.3.—The "Brown Budget" for November, containing articles upon the company's loud-speakers, gramophone pick-up, &c.

MESSRS. JOHNSON & PHILLIPS, LTD., Charlton, S.E.7.—An illustrated and priced folder describing the non-metal-sheathed form of the "J. & P." surface-wiring system, and a leaflet dealing with a wood moulding for concealing the wires.

MESSRS. WINGROVE & ROGERS, LTD., 188-189, Strand, W.C.2.—An illustrated and priced catalogue of "Polar" receiving sets, and a folder dealing with components—condensers, coil holders, &c.

MESSRS. HERBERT MORRIS, LTD., Loughborough.—A well-illustrated booklet advertising the company's electric lifts, &c.

MESSRS. PEYTON & PEYTON, LTD., Bordesley Works, Birmingham.—Two leaflets, illustrated in colour, showing examples of the "Anchorlite" portable electric lamp.

THE HARLAND ENGINEERING CO., LTD., 72-74, Victoria Street, S.W.1.—List X.62/2710, illustrating and describing (with prices) the company's oil circuit-breakers for switchboard mounting, for h.p. and l.p. a.c. circuits.

MEDWAY'S SAFETY LIFT CO., LTD., 1-2, Silex Street, Blackfriars Road, S.E.1.—An illustrated booklet advertising the company's lifts, which are manufactured in conjunction with Messrs. J. & E. HALL, LTD., Dartford.

MESSRS. J. H. TUCKER & CO., LTD., King's Road, Tyseley, Birmingham.—A pamphlet containing prices of tumbler switches of many patterns, and a leaflet advertising the company's ironclad switch- and fuse-gear.

THE SUFFOLK IRON FOUNDRY (1920), LTD., Gipping Works, Stowmarket.—An illustrated booklet on the welding of cast iron.

MESSRS. L. G. HAWKINS & CO., LTD., 30-35, Drury Lane, W.C.2.—A well-illustrated and priced catalogue of "Universal" home appliances—including vacuum cleaners, table cookers, fires, cooking ranges, coffee mills, mincers, h.f. apparatus, &c.

MARCONIPHONE CO., LTD., 210, Tottenham Court Road, W.1.—Publications Nos. 471 and 474, price 6d. each, containing full instructions, blue print, list of components, &c., for building T.1 (4-valve) and T.2 (5-valve) receivers incorporating the S-type shielded grid valves; priced and illustrated.

THE JACKSON ELECTRIC STOVE CO., LTD., 143, Sloane Street, S.W.1.—November calendar-blotter advertising the Jackson "Quickservice" water heater.

Bankruptcy Proceedings.

P. F. BRITTAIN, electrical engineer.—This debtor was adjudged bankrupt in November, 1926. He applied on November 16th to Mr. Registrar Warmington at the London Bankruptcy Court for an order of discharge, when Mr. F. Vyvyan, Assistant Official Receiver, reported that the provable debts amounted to £3,047; the assets, valued at £16,133, had already realised £3,795, and a further £50 would probably be received, the difference between the debtor's estimate and the actual realisation being explained by the fact that the stock, machinery, trade fixtures, patterns and models, although valued at £10,748, had only produced £1,500. A dividend of about 10s. in the £ was expected to be paid. Since 1898 the applicant had carried on business as an electrical engineer, with an office at 110, Cannon Street, E.C., and also as a bronze founder under the style of "Armstrong & Co." In 1912 he purchased the assets of an engineering company for £3 000, and commenced business as "Brittain's Electric Motor Co.," electric motor manufacturer, at Lewisham; the business was successful until 1921, but it was afterwards affected by industrial strikes and foreign competition, and, owing to executions levied at his business premises in August, 1926, he was advised to file his petition. He had also acted as director of two limited companies. He denied that he was insolvent, and attributed his failure to trade depression and to his inability to obtain money to discharge the debts of the execution creditors. Mr. Kendrick, on behalf of the debtor, said he understood that a dividend of not less than 13s. 4d. would be paid to the creditors. His Honour remarked that there was no opposition, and he granted an immediate discharge.

[Our readers are aware that Brittain's Electric Motor Co. is being carried on at Eastdown Works, Lewisham, by Mr. Hitching.—EDS.]

A. LAWRIE, trading as Houchin & Lawrie, 9, Melbourne Parade, Palmers Green, Middlesex, electrical engineer. The following are creditors:—

	£		£
Falk, Stadelmann & Co., Ltd.	220	Jeary Electrical Co., Ltd.	70
General Electric Co., Ltd.	172	Preston & Co.	154
W. T. Henley's Telegraph Works Co., Ltd.	197	Sun Electrical Co., Ltd.	180
		Standard Shade Co. ...	42
		Tungstalite, Ltd.... ...	59
		Randle, Mrs.	100

D. ROSCOE, 4, North Albion Street, Fleetwood, Lancs., late electrical and mechanical engineer.—The adjourned public examination of this debtor was held on November 11th, at Blackpool. The liabilities were returned at £198, against nominal assets of £2. Questioned with reference to an account which he had filed, debtor said that the contracts received between June, 1926, and June, 1927, amounted to £163. On those he ordered goods for £100, and in addition paid £65 on other accounts, so that there was no profit. After further questions with regard to certain transactions, the examination was again adjourned.

E. PRITCHARD, 5, Weavers Buildings Dudley Road, Wolverhampton, electrician.—The public examination of this debtor was held on November 16th, at the County Court, Wolverhampton. The statement of affairs showed gross liabilities of £163, and there was a deficiency of £142. Debtor attributed his failure to speculation in a picture house, unemployment, bad trade, and excessive interest paid to a moneylender. He stated that he had not been very successful in the electrical business. The examination was adjourned.

CHARLES R. W. ROWED and A. E. SMITH, trading as Rowed and Smith, 1, Alexandra Road, Ellacombe, Torquay, electrical engineers and house decorators.—The receiving order in this matter was made on November 2nd, on debtors' own petition. The statement of affairs shows liabilities of £133, against assets of £28, leaving a deficiency of £105. First meeting held November 23rd, at the Official Receiver's office, Exeter Bank Chambers, 67, High Street, Exeter; public examination December 8th, at the Castle, Exeter.

E. AMOS and E. C. WRIGHT (Amos & Wright), electrical and motor engineers, 32, Slater Street, Liverpool.—First meeting, November 28th, at the Official Receiver's offices, 11, Dale Street, Liverpool; public examination December 13th, at the Court House, Liverpool.

W. G. CONWAY (Listron), wireless component dealer, 88-90, Chancery Lane, W.C.—Bankrupt's discharge suspended for three months until January 19th, 1928.

W. HANNA, wireless dealer, 13, Carey Street, Burnley.—Last day for proofs for dividend, December 2nd. Trustee, Mr. H. Parker, Official Receiver, 11, Winckley Square, Preston.

H. B. POWELL, wireless dealer, 10, Union Street, Hereford.—Last day for proofs for dividend, December 3rd. Trustee, Mr. M. G. G. Scobie, 2, Offa Street, Hereford.

G. E. GRAINGER (Grainger & Co.), wireless engineer, 38, Market Street, Ashby-de-la-Zouch.—First and final dividend of 1s. 8½d. in the £, payable November 30th at the Official Receiver's offices, 4, Castle Place, Nottingham.

A. J. MCMAHON, electrical contractor, 51, St. Thomas Street, Weymouth, and Melcombe Regis.—Last day for proofs for dividend November 29th. Trustee, Mr. T. Barton, Official Receiver, City Chambers, Catherine Street, Salisbury.

H. NUTTER, electrical engineer, 246, Yorkshire Street, Rochdale.—First and final dividend of 10½d. in the £, payable at the Official Receiver's offices, Byrom Street, Manchester.

Company Liquidations.

THOMAS GUNN, LTD., 30, Fore Street, E.C.2, and elsewhere, wholesale, retail and manufacturing ironmongers, &c.—In accordance with resolutions passed at a recent meeting of creditors, Mr. W. A. J. Osborne, of Messrs. Corfield & Cripwell, Balfour House, Finsbury Pavement, E.C., has been appointed to act as co-liquidator with Mr. F. H. Bennett, F.A., 59, Chancery Lane, E.C., the liquidator appointed by the shareholders. A circular has been issued to the creditors by the liquidators stating that the committee feels that there are prospects of resuscitating the business. It is of the opinion that efforts should be made to discharge the debentures. The following are creditors:—

	£		£
Brown Bros. Ltd. ...	155	Gross, Sherwood & Heald, Ltd.	232
British Thomson-Houston Co., Ltd.	714	Harris, J. T. G., Ltd. ...	142
Churchill, C., & Co., Ltd.	55	Hunt, Barnard & Co., Ltd.	175
Condrup, Ltd.	284	Johnson & Phillips, Ltd.	107
Croggon & Co., Ltd. ...	44	Millard Bros.	85
Crowden & Keeves, Ltd.	61	Marconiphone Co., Ltd.	22
Carborundum Co., Ltd.	25	Millbrook Mfg. Co., Ltd.	33
Cooper Stewart Eng. Co., Ltd.	155	Nettlefold & Sons, Ltd....	24
Calnans, Ltd.	46	Nico Light Co., Ltd. ...	60
Drummond Bros., Ltd. ...	158	Needham, Veall & Tyzack	97
Ever-Ready Co. (Gt. Britain), Ltd.	245	Phillips, J., Ltd.	80
Falk, Stadelmann & Co., Ltd.	807	Philips Lamps, Ltd. ...	28
Fordham, W. B., & Sons, Ltd.	209	Russell & Erwin Mfg. Co., Ltd.	45
French, W. T., & Son ...	266	Ruberoid Co., Ltd. ...	20
General Electric Co., Ltd.	495	Siemens & English Electric Lamp Co., Ltd. ...	318
Gibbons, Skinner & Co., Ltd.	74	Sloan Electrical Co., Ltd.	134
Guiterman, S., & Co., Ltd.	26	Siemens-Schuckert, Ltd.	94
Godiva Engineering Co., Ltd.	709	Trice & Chapman, Ltd....	123
Gibson, G. F., & Co. ...	437	Volta, Ltd.	93
		Welsbach Light Co., Ltd.	57
		Wholesale Fittings Co., Ltd.	64

NORTON WIRELESS CO., LTD.—Winding up order made by the High Court on November 15th.

FOOLPRUFE PATENT ACCUMULATOR CO., LTD., Market Harborough.—A meeting of members is called for December 19th at 32, The Square, Market Harborough, Leicestershire, to hear an account of the winding up from the liquidators, Mr. J. B. Bullivant and Mr. G. T. Berry. A first and final dividend of 3s. 7½d. in the £ has been declared.

Dissolutions of Partnership.

T. BOTTOMLEY AND THE WALTER R. BOTTOMLEY PRIVATE TELEPHONE CO., timber merchants and electrical engineers, Railway Saw Mills, Brighouse.—Mr. W. A. Bottomley and Mr. W. R. Bottomley have dissolved partnership.

W. H. AXWORTHY & CO., electrical engineers, Plymouth.—Messrs. W. H. Axworthy, E. P. J. Summers, and P. V. Blackler have dissolved partnership. Messrs. Axworthy and Summers will continue the business.

The British Industries Fair.

Mr. G. N. Guest, president of the Birmingham Chamber of Commerce, which has charge of the Birmingham section of the Fair, recently stated that every year they are compelled to add to the permanent structures at Castle Bromwich, but when, in providing for the 1927 display they put on a further 120,000 sq. ft. at a cost of £30,000, they believed that they had

in some measure forestalled future developments. Last February, nevertheless, every foot of space was occupied, and while the Fair was still in progress meetings of the Management Committee were held to consider the best method of extension for 1928. The bold course was then suggested of doing away completely with the communicating corridor and replacing its entire length (650 ft. long) with a steel-and-brick building. Even so, a two-span permanent structure giving extra accommodation of 70,000 sq. ft. at a cost to the Chamber of £20,000 was found to be inadequate, and more recently a third span, giving an addition of 105,000 sq. ft., was authorised at a total cost of £30,000. The 1927 buildings are already full, and there is not the least doubt that the whole of the new space will have been definitely appropriated before the end of November. Then they will have to do the best they can in the way of emergency accommodation and they will use their utmost endeavours to see that representation of some kind is secured to those who still wish to exhibit.

For Sale.

Bedford Corporation invites offers for one 1,000-kW mixed pressure turbo-alternator and condensing plant. Messrs. G. Sworder & Sons will sell by auction on November 29th, at the Chequers Hotel, Bishops Stortford, the freehold premises known as the "Fox Brewery," comprising engineers' shop, fitters' room, &c. Messrs. Edward Rushton, Son & Kenyon will sell by auction on December 6th, at the Thatched House Hotel, Manchester, the vulcanised fibre and can works known as Crumpsall Mill (Sutcliffe (of Crumpsall), Ltd.), with the plant and machinery, &c., together with the goodwill of the business. Messrs. Richardson & Linnell will sell by auction on December 7th, at Eastwood Swingler & Co.'s Works, Derby (owing to the premises being acquired by the Derby Corporation) engineering, &c., plant, tools, electric motors, switchboards, &c. (See our advertisement pages to-day.)

Book Notices.

"Dental Service in Industry." (50 pp., ill.) London: The Industrial Welfare Society.—This is designed as a guide to industrial firms in the setting-up of dental clinics, and it also offers suggestions for attracting employés' attention to the need for oral hygiene.

"Psychology as a Sales Factor," by A. J. Greenly. London: Sir Isaac Pitman & Sons, Ltd. 10s. 6d. net.—We commend this book to the notice of readers who are connected with any branch of salesmanship, and more particularly those who have to do with publicity and advertising service. The subject is too large for us to attempt here that full review that it deserves, and we make no pretence to having made the analysis of a specialist in preparing this notice. From the perusal that we have so far been able to give to the book—and we intend to read it further—we think that those who are interested in salesmanship and advertising activities as part of their career will find a study of Mr. Greenly's views interesting and thought stimulating, as well as being profitable in a practical sense. The author has had a lengthy experience of advertising in connection with the general trades, and is by no means a stranger to the electrical industry. Nobody can efficiently follow such a business without devoting much thought to the mind and moods of the purchaser and the multifarious influences which modern publicity exercises in leading him to buy this and reject that.

Journal of the Institution of Electrical Engineers. Vol. LXV. No. 371, and Index to Vol. 65. November, 1927. London: E. & F. N. Spon, Ltd. Price 10s. 6d.

Books on Civil Engineering.—The McGraw-Hill Publishing Co., Ltd., will be pleased to send copies of its new civil engineering book catalogue, post free, on application.

New Australian Companies.

A company, called the Electrical Plant Manufacturers Pty., Ltd., has been formed in Victoria to carry on the business of transformer manufacture in that State. Its capital is £25,000.

A company has been registered in Melbourne with a capital of £50,000 and the title Oliver J. Wilsen & Co. Pty., Ltd., to carry on the business of electricians, mechanical engineers, &c.

Social Events.

The first Siemens social of the season was held on November 18th, at St. Bride Institute, E.C., taking the form of a whist drive and dance. The Bohemians Dance Band provided music, and there was community singing during the evening.

For four nights, commencing November 16th, the Metropolitan-Vickers Amateur Dramatic and Operatic Society presented Ernest Denny's comedy, "All of a Sudden Peggy," at the Metrovick Club. The club hall has a splendidly equipped stage, and the performances of the comedy were very well carried through. The leading part of Peggy was well done by Miss E. Hartley, despite the fact that this was her first appearance. She played opposite Mr. E. C. Scott, a thoroughly experienced amateur who has already acquired a local reputation for talented acting. They were handsomely backed by the rest of the cast, who in every instance filled their respective parts more than adequately. The first performance was attended by Capt. and Mrs. Hilton, Mr. and Mrs. G. E. Bailey, and various heads of departments and their wives.

The Victorian Electrical Exhibition.

Mr. Walter Richards, manager of the Electrical Federation (Victoria), has sent us some particulars of the All-Electrical Exhibition recently held in Melbourne, of which he was secretary. He says that there were 72 stalls of trade exhibits devoted to electrical and radio appliances produced in Australia, Great Britain, America, and the Continent. There were also a number of Government exhibits, such as the Postmaster-General's stand, showing telephony and telegraphy, and the Victorian Railways, who exhibited the stripped chassis of a suburban electric railway carriage (weighing 42 tons), substation equipment, and electric signalling. The State Electricity Commission, the Melbourne City Council, and the Melbourne Electric Supply Co. jointly erected two complete electrical homes, an electric farm, and an electric fountain. The Melbourne Tramways Department showed the stripped chassis of a tram bogey, and other electrical service, and the fire brigades exhibited electric fire alarm systems. The total area occupied by the Exhibition, including an electrical restaurant—where meals were served to the public—and a space devoted to moving pictures on electrical subjects, was approximately three acres. The Exhibition was opened for three weeks, and during that time drew an attendance of 157,000 people. "All stallholders have been agreeably surprised at the heavy volume of direct business resulting from the Exhibition, while it is safe to say that through it the electrical industry here has received an impetus which will be shown in appliance, contracting and energy sales for a long time to come."

Prices of Raw Materials.

Messrs. James Forster & Co. reported on November 19th that during the preceding week the Continent had bought lead fairly well, but consumers here had been little in evidence, reports, particularly from the electrical trades, being of a very poor character. Indeed, consumers generally complained much of slow trade, and showed little disposition to anticipate the future. On the other hand, the feature of the week on the Metal Exchange was heavy buying of February shipment lead. The Board of Trade returns, while smaller than of recent months, were still more than sufficient for current needs.

Messrs. F. Smith & Co. report, November 22nd: Copper (electrolytic) bars, £64 15s., 15s. inc.; ditto ditto sheets, no change; ditto ditto wire rods, £74 15s., 15s. inc.; ditto ditto h.c. wire, 9⅛d., 1/16d. inc.

Messrs. James & Shakespeare report, November 22nd: Copper bars (best selected), sheet and rod, no change; English pig lead, £22 10s., 10s. inc.

Messrs. Edward Till & Co. report, November 22nd: No change in the price of India-rubber, Para fine.

Lighting and Power Notes.

Abertillery.—Inquiry.—An inquiry was held recently by Mr. J. C. Dawes, for the Minister of Health, and Mr. A. N. East, for the Electricity Commissioners, into an application by the Urban District Council for sanction to a loan of £28,337 for the erection of a refuse destructor. According to the *Western Mail*, Mr. Arthur Ellis, of Cardiff, consulting electrical engineer to the Council, in dealing with the scheme, said the present destructor was in a very dilapidated state and the scheme was justified on that ground and because the present destructor was incapable of dealing with the present refuse of the town. If the Ministry gave its consent to the proposal for a new destructor the Council would, with the consent of the Electricity Commissioners, make use of the waste heat available for the generation of electricity. By the utilisation of waste heat gases it could generate, subject to the refuse being available, six million kWh of electricity annually. He estimated the requirements of Abertillery in the course of the next two or three years at 750,000 kWh; at present it was 404,000 kWh. The electricity generated by the plant which the Council did not require would be sold to the South Wales Power Company under an agreement. There would be a saving effected of £9,000 a year. The Commissioners will give their decision in due course.

Australia.—Tasmania.—A survey has been made of the north-eastern district of Tasmania with a view to ascertaining the possibility of giving power supply, chiefly to the tin mining companies, from the system of the State Hydro-Electric Department. The minimum scheme of supply would be the construction of a 44,000-V line at a cost of £54,000. This, however, would only convey 1,000 h.p., and is not considered adequate. A more suitable scheme would involve the construction of an 88,000-V line to Moorina, with distribution at 22,000 V to Gladstone, Branxholm and Lottah. This would cost £125,000. The *Electrical Engineer of Australia and New Zealand* states the Hydro-Electric Department has not been able to get any of the mining companies to enter into guarantees regarding their annual payments for power. Many have expressed willingness to avail themselves of the supply, and have stated the amounts of power they will need, but they will not bind themselves

to any contract. The chief engineer of the department, Mr. H. A. Curtis, says that he cannot recommend the construction of lines to serve the district unless guarantees are forthcoming.

CANBERRA.—An agreement has been drafted whereby New South Wales will supply Canberra with electricity from the Burrenjuck hydro-electric scheme. The construction of the necessary lines, &c., will cost the State £100,000.—*Reuter* (Sydney).

Audlem.—ELECTRICITY SUPPLY.—At a recent meeting of ratepayers a resolution was passed in favour of an electricity supply for the parish if available at an early date and at a reasonable cost. This is in consequence of the pending closing down of the local gas works. Mr. Latham, of the North Wales Power Company, is to be interviewed regarding a supply.

Bangor.—ELECTRICITY SUPPLY.—The Corporation Lighting Committee has under consideration a plan for extending the h.p. mains to Penrhyn Castle.

Barkisland (Yorks.).—ELECTRICITY IN BULK.—The Urban District Council has decided to ask the Electrical Distribution of Yorkshire, Ltd., at what price it would be prepared to deliver electricity in bulk.

Barnes.—LOAN SANCTIONED.—The Urban District Council has received sanction to a loan of £6,340 for electricity purposes.

Bromley (Kent).—PURCHASE OF UNDERTAKING.—The Town Council has completed the purchase of the undertaking of the Bromley (Kent) Electric Light and Power Co., Ltd., for £139,702 plus £1,664, agreed valuation of stores, &c.

Burton-on-Trent. — LOAN SANCTIONED. — The Corporation Electricity Committee has received sanction to a loan of £3,850 for the provision of switchgear at the electricity works.

Cheshire.—OPPOSITION TO SCHEME.—A committee of the County Council has interviewed the managing director and the engineer of the Electricity Distribution of North Wales and District, Ltd., with regard to the erection of overhead transmission lines in the parishes of Weston, Shavington, Willaston and Wistaston. The Council has decided to take such steps as may be considered necessary to resist any application by the Company for permission to use overhead transmission lines.

Colchester.—LOAN SANCTIONED.—The Town Council has received sanction to a loan of £25,000 for electricity purposes, comprising £15,000 for land, buildings, civil engineering works, and crane, £3,000 for mains, and £7,000 for plant.

Continental.—RUSSIA.—The laying of the foundation stone of the hydro-electric power station (Dneprostroï) on the Dnieper took place on November 8th. This station will be not only the largest in the Soviet Union, but also the largest in Europe. The full utilisation of the 650,000 h.p. of the station is expected to be a factor of enormous economic importance for the Ukraine and the whole of the Soviet Union. It is estimated that the new electricity supply will render possible a saving of 5,000,000 tons of coal a year.—*Reuter's Trade Service* (Moscow).

SWEDEN.—The Sieverts Cable Co., of Sundbyberg, near Stockholm, has recently completed a large cable to supply electricity to the Isle of Oland off the Swedish coast. The cable is 14,500 ft. in length, weighs about 180 tons, and is to transmit three-phase current at 55,000 V. The three conductors are lead-sheathed and wrapped in steel wire and asphalted jute.

LUXEMBURG.—The Government has negotiated a loan of 90,000,000 fr. to carry out a scheme of electrification in the Duchy. A French bank is to supply the funds, its terms having been considered the most favourable, but a group of British financiers has agreed to underwrite a portion of the loan. The French bank's offer may be submitted for approval to the Chamber of Deputies.—*Reuter* (Luxemburg).

Hastings.—ASSISTED WIRING SCHEME.—The Corporation Electricity Committee is to put in operation an assisted wiring scheme for the districts of Battle and Rye which are now in the Council's area of supply.

LOAN.—The Committee is applying for sanction to a further loan of £11,000 for mains and transformers.

Huddersfield. — ELECTRICITY SUPPLY PROGRESS. — It was stated at the annual meeting of the Town Council, held recently, that the increase in the number of electricity consumers during the year was 1,571, and that the demand for cooking, heating and domestic appliances had shown a considerable increase.

India. — HYDRO-ELECTRIC DEVELOPMENT. — The Shannon hydro-electric scheme in the Punjab, is showing rapid progress in construction. The first stage is expected to be completed within two years and power may be actually available in 1930. The Punjab Government has a number of schemes under consideration, the first of which will be on the Uhl river, which is a tributary of the Baas. The Uhl river combines all the advantages of the tunnel scheme of the pressure type with a large storage. It has a gross head capable of development in three stages of not less than 3,550 ft. with an ultimate yield of 185,000 h.p. The first stage will yield 36,000 h.p. In the second construction stage, a dam will be provided, and by this means the electrical power developed will be raised to 95,000 h.p. When this is completed the tail water from the power station will pass through an open duct for three miles and drop through a fall of 1,200 ft. to a second power station on the Rana, where an additional 65,000 h.p. will be generated. There will be a third fall which can be utilised later if necessary, and the works are so designed as to permit of small expansions in various other ways. The capital cost of the first stage of the scheme will be 4¼ crores of rupees, including the cost of the transmission lines, etc., and provides for local distribution and street lighting in 20 towns. The later stages will provide electricity to another 39 towns. Arrangements with industrial users and others have already been completed and a number of railway electrification schemes, including the electrification of the Kalka-Simla line, are under investigation.

Lichfield.—SPECIAL ORDER.—The Electricity Commissioners have submitted to the Minister of Transport for confirmation a Special Order made by them authorising the City Council to supply electricity in the rural district of Lichfield.

London.—BERMONDSEY.—The Borough Council Electricity Committee has authorised mains extensions at a cost of £1,160.

FULHAM.—The Borough Council has received sanction to a loan of £3,937 for a gatehouse and sub-station at the electricity works.

PRICE REDUCTION.—The St. James' and Pall Mall Electric Light Co., Ltd., has announced that from the reading of the meters for the quarter ended Christmas, 1927, the charge for electricity for lighting will be reduced from 5d. to 4½d. per kWh for the first 4,000 kWh per annum.

New Zealand. — ELECTRICAL DEVELOPMENT. — The Marlborough Power Board has recently put into operation its hydro-electric power station at Benopai on the River Waihopai. According to the *Electrical Engineer of Australia and New Zealand*, the site permits of a development of 1,900 h.p. and the plant installed includes two Francis type turbines, each driving a 500-kW, 6,600-V alternator. Electricity is transmitted to Blenheim at a pressure of 33,000 V. The primary distribution is carried out at 11,000 and 6,600 V, and the secondary reticulation is at 400-230 V, 50 cycles, three-phase.

Northern Ireland.—PORTSTEWART (CO. DERRY).—At a recent meeting of the Urban District Council an amended plan was submitted of the proposed new generating station. It was decided to apply to the Electricity Commissioners for permission to borrow £3,000 for the purpose of erecting and equipping the new station.

LURGAN (ARMAGH).—The Urban District Council is applying to the Electricity Commissioners for Northern Ireland for a further loan of £6,000 to complete the electricity scheme for the town.

Oldham.—REVISION OF CHARGES.—The Corporation Electricity Committee has recommended that as from December 25th next the charges for the supply of energy be fixed as follows:—Lighting: Flat rate: 4½d. per kWh. Two rate: all energy consumed between the hours of 4 p.m. and 8 p.m., 6d. per kWh, and all energy consumed between the hours of 8 p.m. and 4 p.m. (*i.e.*, 20 hours), 3d. per kWh. Heating and cooking: 1d. per kWh.

ELECTRICITY SUPPLY.—The Corporation Electricity Committee has agreed to provide a supply of electricity to the Stalybridge, Hyde, Mossley and Dukinfield Tramways and Electricity Board.

Portsmouth.—EXTENSION OF SUPPLY.—The Town Council has decided to extend the mains to supply electricity to Lee-on-Solent at an estimated cost of £14,500.

Scunthorpe.—SCHEME POSTPONED.—At a recent meeting, the Urban District Council referred back a recommendation to apply for an Order to supply electricity to areas outside the district. During the discussion it was contended that there was nothing in the scheme to recommend it to the Council, and that it had not heard of any support for the scheme from the outside areas. There did not appear to be any urgency unless the Council was going into the Isle of Axholme or to Crowle. The Yorkshire Electric Power Co. was already in the area, and it was an area which the company could supply better than the Council.

Southend-on-Sea.—PRICE REDUCTIONS.—We are informed by Mr. R. Birkett, borough electrical engineer, that from January 1st next, the following reductions in the charges for electricity will be made:—Flat rate: from 6½d. to 5½d. per kWh. Kilowatt rate: from £9 5s. per kW and 2d. per kWh to £8 15s. and 1½d. respectively. Contract rate: from £21 10s. to £21 per kW.

Stourport.—POWER HOUSE EXTENSIONS.—Although the first stage of the power house of the Shropshire, Worcestershire and Staffordshire Electric Power Co. was inaugurated as recently as June last, large extensions of buildings and plant are already in progress. The existing plant of 50,000 h.p. is being augmented by an additional 30,000 h.p. set, together with two water-tube boilers having a total evaporative capacity of 180,000 lb. per hour. In addition to generating plant extensions, a large capacity e.h.p. transmission line is in course of construction between the power station and the Halesowen district of the company's area. The Company has a large programme of extensions for the year 1928, which includes h.p. lines between Stourport, Bewdley, and Bridgnorth, and an e.h.p. line between Stourport and the Ludlow District *via* Tenbury.

Tilbury.—Loan.—The Urban District Council has applied for sanction to a loan of £3,000 for wiring installations.

Wakefield.—Year's Working.—The accounts of the Corporation electricity undertaking for the past year show a net profit of £8,090. The consumption of electricity for private lighting and heating amounted to 2,110,971 kWh, representing 38.6 kWh per head of population, as compared with 799,374, and 14.5 respectively in 1920.

Loan Sanctioned.—The Electricity Committee has received sanction to a loan of £12,500 for additional boiler plant at the generating station.

West Midlands.—Ironbridge Station Site.—The West Midlands Electricity District (Ironbridge Generating Station) Special Order, 1927, has been made by the Electricity Commissioners and confirmed by the Minister of Transport in respect of the compulsory purchase of approximately 64.372 acres of land at Buildwas, in the County of Salop, by the West Midlands Joint Electricity Authority whereon to build a new generating station. The site is served by the River Severn and the Great Western Railway (Severn Valley branch from Shrewsbury); other land may be purchased hereafter by agreement.

Tramway and Railway Notes.

Colne.—Motor-'bus Service.—The Mayor stated on November 17th that, whilst there was nothing to equal the electric tramcar for moving large masses of people in the shortest time, tramcars did not pay in thinly-populated areas. Colne scrapped one length of its tramway system some time ago, and substituted 'buses, which had proved successful. The Corporation's motor-'bus undertaking, launched four years ago, is now dealing with 1½ million passengers per year. Rossendale, Bury and Ramsbottom Councils have negotiated for an agreement for co-ordination of their motor-'bus undertakings, and inter-service running has been agreed upon.

Continental.—Austria.—The Vienna correspondent of *The Times* reports that the Government has decided to proceed no further with the electrification programme of the Austrian State Railways, but to utilise the remainder of the fund, set aside for this work out of the international loan, for other purposes. It is stated that those portions of the electric railways now under operation are working at a financial disadvantage, as compared with those with steam traction. All the initial calculations are now found to be inaccurate. The possibility of a cheapening of imported coal and of too favourable estimates of the cost of electrification were, it seems, left entirely out of consideration. As a result also of progress in other countries in the technique of generation of steam from coal dust and inferior coal, it is believed that the Austrian railways will in future have to import only 1,350,000 tons of Czecho-Slovak and German coal to meet their requirements.

Ilford.—Tramway Improvement.—In anticipation of the establishment of a greyhound racing track near Eastern Avenue the Corporation Tramways Committee has recommended the doubling of the tramway track in the vicinity at a cost of £4,250, so that the tramway will be able to deal with the increased traffic.

India.—Bombay.—The Corporation is asking the Bombay Electric Supply & Tramways Co., Ltd., to take steps for the extension of the tramways from the Dadar terminus to Matunga.

London.—Breakdown.—Owing to an electrical defect in a train on the Central London Railway shortly after 11 p.m. on November 17th, the service between Liverpool Street and the Bank was suspended. Normal working was resumed at 12.30 a.m.

L.M.S. Electrification.—Sir Josiah Stamp, chairman of the London, Midland and Scottish Railway, recently referred to the possibility of the electrification of the system. According to the *Financial News*, he stated that the electrification of various parts of the line is under review, but whether it will be undertaken depends upon whether it is an economic possibility. It would be a long time before the electrification of long-distance main-line traffic could be justified. The cost of distribution of current and of the provision of new rolling-stock to replace that which electrification made obsolete were two main factors which had to be considered in relation to any economic scheme. The conditions governing the suburban traffic on the L.M.S. were quite different from those on some of the other lines which had undertaken big electrification schemes.

Musselburgh.—Abandonment of Tramway.—Mr. W. B. Cownie, of London, managing director of the Musselburgh and District Electric Light & Traction Co., Ltd., has announced his company's intention of scrapping 3½ miles of Musselburgh tramway track in the Prestonpans and Port Seton area, as the route does not pay. The service will be replaced by motor-'buses.

Telegraph and Telephone Notes.

Australia.—Radio-Telegraphy.—Speaking in the House of Representatives in connection with the proposed fresh agreement with Amalgamated Wireless (Australia), Ltd., Mr. S. M. Bruce, Prime Minister, said a problem which might arise in the future was the rival merits of the wireless and cable services; probably the cables were essential to defence, and were necessary as an auxiliary to the wireless services. The co-ordination of these methods of communication might have to be faced, and it might be suggested that co-ordination would be difficult to effect if the success of the "beam" system proved phenomenal; the Commonwealth would not allow such a position to arise. The Company, he announced, had agreed to pay terminal charges from March 28th, 1926, the amount due being approximately £25,000. On the basis of nine million words per annum, the Company would pay approximately £45,000. The Commonwealth had agreed to make a contribution of £45,000 a year for the maintenance of coastal stations in exchange for the terminal rates, the Company agreeing to pay the Commonwealth 30 per cent. of the revenue from the stations. The average losses of the stations for the five years of Government control had been £34,000.—*Reuter* (Canberra).

Czecho-Slovakia.—Automatic Telephony.—In our October 14th issue it was reported that the Siemens & Halske Co., of Berlin, had obtained from the Czecho-Slovak Telephone Administration an important order for the existing telephone system to be converted to an automatic system. We are now informed by Telegraphia, Ltd., of Prague, that the substantial order referred to was only for the extension of one of the existing automatic exchanges that have been equipped on the system of the Siemens & Halske Co.

Philippine Islands.—Radio Service.—Day and week-end letter telegram services, *via* Marconi, were recently inaugurated to the Sandwich and Philippine Islands.

Radio Conference.—Articles Ratified.—The International Radio Conference at Washington made decided progress on November 10th under the chairmanship of Mr. H. Hoover. Eighteen articles of the new Radio Convention and of the accompanying wireless regulations referred to the Conference by the Committees were ratified in plenary session; five articles were sent back to the Committees for redrafting. The articles adopted, which differ only slightly from those of the London Convention, specify the procedure to be adopted for communication between land and ship stations, and include rules for the licensing of stations, and safeguards against interference with distress calls from ships. The Belgian delegate stated that his Government had expressed its willingness to hold the Telegraph Conference in Brussels next year instead of in 1930.—*Reuter* (Washington).

Radio-Telegraphy.—Dominion "Beam" Service.—A preliminary test of the "beam" service between Australia and Canada has proved satisfactory; it consisted only of the transmission of signals from Canada for the purpose of making final adjustments to the Australian receiver. The Australian transmitter for communication with Canada has been completed for some time, and successful local tests have been held, but it has not been used for communication tests with Canada.

Spain.—Telegraph Service.—A return relating to the activities of the Spanish Telegraph Department during 1925, which has lately been issued, shows that the number of telegraph offices in the country declined from 3,394 in 1924 to 2,944, and the length of the telegraph line in use from 35,272 to 31,780 miles. Although the number of messages dealt with increased from 14,608,369 to 15,737,479, there was a falling off in the receipts from 25,127,557 pesetas in 1924 to 19,507,087 pesetas in 1925. The service is apparently run at a loss, the return showing that the cost of operation and maintenance amounted to 44,493,324 pesetas, as against 48,833,512 pesetas in the earlier year.

Radio Notes.

Australia.—Demonstration Train.—Country listeners have often complained of the difficulties they experience in selecting sets suitable for the locality they are in, and 3LO is now considering equipping a special railway train to tour the country for the benefit of listeners. The train would carry a large variety of wireless sets and accessories, and be accompanied by experts, whose advice would be of great benefit to listeners unable to obtain the services of experts owing to their distance from the cities.—*Reuter's Trade Service* (Melbourne).

New Government Agreement.—The new wireless agreement Bill submitted by Mr. S. M. Bruce, Prime Minister, to the House of Representatives provides for the continuance of Commonwealth control over commercial wireless conducted

by the Amalgamated Wireless Co., all charges being subject to the approval of the Commonwealth. The Company's patent rights are to be available for five years free of charge to wireless traders and broadcasting agencies; fees for listeners are to be reduced by 3s. 6d. to 2ds. The Company has agreed to grant a licence free of royalty to every newspaper broadcasting station in the Commonwealth for the purpose of receiving official news from the British Government.—*Reuter* (Canberra).

The Company is waiving its present charges to broadcasters and listeners and receiving instead 3d. per month from the Government in respect of every listener's licence. The Company is to test the validity of its patent rights.

NEW SHORT-WAVE STATION.—The Melbourne station (3LO), on November 21st, commenced to conduct a regular Empire transmission for two hours every Monday afternoon from 4.30 Melbourne time (6.30 a.m. London time), using a wave-length of 36 metres.

British Licences.—STEADY INCREASE.—The number of radio broadcast receiving licences in force on October 31st was 2,337,000, compared with 1,599,520 on the same date last year, an increase of 737,480. The number of free licences issued to blind listeners since the service was started at the beginning of the year is 10,000.

Germany.—RADIO "EXCHANGES."—The reported installation of a communal receiver at Frankfurt-on-Main extends the system of private relays which has already been widely adopted in Germany, with the approval (given experimentally) of the Reichspost, and in Darmstadt plant capable of supplying many thousands of subscribers was initiated a short time ago. The method is to install central receiving apparatus and lay suitable lines to subscribers, who pay a monthly subscription fee of M. 4, two of which (the ordinary broadcast licence fee) go to the Reichspost. The system is particularly well suited to new tenement buildings and settlements, says *World Radio*, and many of the larger hospitals in Germany have adopted the system.

Greece.—NEW STATIONS.—The Government has decided to establish a broadcasting station in Athens and relay plant at Corfu and Salonica is projected. Government regulations permit of the use of frame aerials only for reception.

United States.—SHORT-WAVE STATIONS.—At least 22 American stations have installed short-wave transmitters (using different call signs to those of their parent stations) for the purpose of relaying programmes.

RADIO EXPORTS.—The value of exported radio apparatus from the United States during 1926 amounted to £1,758,890, according to the Department of Commerce. Over fifty per cent. was for North and South American countries. The total export value dropped £220,000, or 11 per cent. in 1926, due largely to the decrease of exports to Canada. North America took 20 per cent. less in 1926 than in 1925, South America increased its purchases 21 per cent. in 1926 over 1925 and 39 per cent. in 1925 over the preceding year.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Argentina.—BUENOS AIRES.—January 17th. National Sanitation Works Department. Three 350-kW Pelton-type turbines and 6,600-V, three-phase generators. Two 20-kVA 3-phase static transformers, one distribution switchboard and connections. (B.X. 3921.)*

Australia. — MELBOURNE. — January 3rd. Postmaster-General's Department. Switchboard lamps, lamp caps, and lamp sockets. (B.X. 3943.)*

January 11th. Electricity Department. Replating battery of accumulators. Specifications from the City Electrical Engineer.

January 23rd. State Electricity Commission of Victoria. 6,600-V automatic induction voltage regulators. (B.X. 3972.)*

Ayr.—November 29th. Tramways Committee. Stores for 12 months, commencing January 1st, 1928, including overhead line material, &c. Forms of tender from the Manager.

Blackpool.—December 15th. Electricity Committee. One 1,750-kW motor-convertor for traction supply. (November 11th.)

Dewsbury.—December 12th. Corporation. Pumps, motors, and other electrical plant for the Ravensthorpe sewage works. Specification (£2 2s.) from the borough engineer, Mr. H. Dearden.

Egypt.—CAIRO.—Egyptian State Railways, Telegraphs and Telephones. Chief Inspecting Engineer, Queen Anne's Chambers, Broadway, Westminster, S.W.1. Copper wires and cables for telegraphs and telephones, approx. £E.6,500 to £E.7,000.—*Reuter's Trade Service* (Cairo).

December 14th. Telegraph and telephone material (approx. £E9,800 to £E10,100).—*Reuter's Trade Service* (Cairo).

Glasgow.—November 28th. Corporation. Electrical installation for the City Chambers. Specification from Town Clerk.

Harrogate.—November 28th. Electricity Department. Twelve months' supply of cable. (November 18th.)

Hastings. — December 5th. Electricity Department. One turbo-alternator and one water-tube boiler. (November 4th.)

Hull.—December 7th. Electricity Committee. Boiler house steel structure, h.p. water-tube boilers, coal- and ash-handling plant. (November 4th.)

Leeds.—November 30th. Electricity Committee. Coal (small slack or similar material) required during half-year ending June 30th, 1928, or, alternatively, year ending December 31st, 1928. Form of tender from Electricity Department, 1, Whitehall Road.

London.—CENTRAL ELECTRICITY BOARD.—December 22nd. 132,000-V transformers for the Central Scotland Electricity Scheme, 1927. (November 11th.)

STEPNEY.—November 30th. Board of Guardians. Installation of an electric lift at the St. George's-in-the-East Hospital. (November 18th.)

BERMONDSEY.—November 29th. Borough Council. Microphone and loud-speaker apparatus for the public hall at the Central Baths. (November 18th.)

Lourenco Marques.—February 13th. Ports and Railways. Two 350-h.p. electric motors. (B.X. 3996.)*

Manchester.—November 28th. Electricity Committee. H.p. steam and feed-water pipework. (November 4th.)

December 5th. Steel valves and traps for h.p. steam and water. (November 18th.)

December 13th. Tramways Committee. Magnetic track brakes for tramcars. Specifications from Mr. H. Mattinson, general manager and chief engineer, 55, Piccadilly, Manchester.

November 29th. Trolley wire (electrolytic copper and cadmium copper). Specification from Mr. H. Mattinson.

November 30th. Education Committee. Electric lighting installation, including generating plant, for the Soss Moss special school, Warford, near Alderley Edge, Cheshire. Specifications (21s.) from the Education Offices, Deansgate, Manchester.

New Zealand.—WELLINGTON.—January 10th, 1928. Public Works Department. Additional 110,000-V switchgear, steelwork and control board for Arapuni electric power supply. (B.X. 3837.)*

January 17th. 110,000-V switchgear, protective apparatus, steelwork, storage batteries, &c., for the Waikaremoana power scheme. (B.X. 3858.)* 50,000-V switchgear and steelwork for Arapuni. (B.X. 3917.)* 11,000-V switchgear and metering equipment for Arapuni (Sec. 254). (B.X. 3920.)*

January 24th. 11,000-V switchgear and metering equipment for Arapuni (Sec. 261). (B.X. 3918.)*

CHRISTCHURCH.—March 13th. Drainage Board. Nine electric centrifugal sewage pumping plants. (A.X. 5457.)*

Oldham.—December 3rd. Electricity Committee. Railway sidings at new power station. (November 18th.)

Porthcawl (Glam.).—December 5th. Electricity undertaking. Switchgear, transformers, overhead and underground mains. (November 11th.)

Preston. — December 14th. Electricity Committee. 32,000 tons of fuel for Ribble power station, Penwortham, required during the year ending December 31st, 1928. Specification from Mr. J. F. Simpson, borough electrical engineer, 118, Fishergate.

Rhyl.—December 17th. Electricity Department. 3,400 yd. e.h.p. cable, e.h.p. switchgear, two 250-kVA static transformers, l.p. switchgear, 880 yd. armoured cable. (See this issue.)

Salisbury.—December 1st. Town Council. Installing internal private telephone system, Council House. Mr. W. J. Goodwin, city engineer.

Shipley.—December 5th. West Riding Education Committee. Electric lighting installation at Shipley Salt Schools. Specifications from Education Department, County Hall, Wakefield.

South Africa.—Johannesburg.—January 3rd. Municipal Council. 32 Transformers. (B.X. 3991.)*

December 29th. S.A. Railways and Harbours. One 5-ton 3-motor electric overhead travelling crane for East London workshops. (A.X. 5506.)*

Tilbury.—December 14th. Electricity Department. Two 250-kW transformers and two h.p. switch cubicles. (See this issue.)

Uruguay.—Montevideo.—December 19th. State Electricity Works. Six Diesel oil-engine generating sets. (B.X. 3966.)*

February 5th. Ministry of Public Works. 22 cranes for the Hydrographic Department. (A.X. 5478.)*

West Ham.—December 1st. Board of Guardians. Electrical repair work at the Forest Gate Sick Home. (See this issue.)

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Ashford (Kent).—East Ashford Rural Council. Accepted:—

Installing electric pumping plant at the South Willesborough sewage works (£232, plus about £20 for extras).—Tangyes, Ltd.

Cumberland.—

Electric lighting and power installation for central premises of Cleator Moor Co-operative Society, Ltd.—T. S. Bell & Co. (Whitehaven).

Dartford.—Electricity Committee. Recommended:—

750-kW motor generator (£2,740).—General Electric Co., Ltd.

Government Contracts.—The following contracts were placed by various Government departments during October:—

Admiralty Contract and Purchase Department.

Conduit accessories.—Eureka Conduits & Fittings Co., Ltd.; Barton & Sons; Electrical Conduits, Ltd.
Ammeters.—Everett, Edgcumbe & Co., Ltd.
Battery gear.—Fuller Accumulator Co. (1926), Ltd.; Premier Accumulator Co. (1921), Ltd.
W/T boards.—Whipp & Bourne, Ltd.
Carbon brushes.—Morgan Crucible Co., Ltd.
Electric cable installation.—W. T. Henley's Telegraph Works Co., Ltd.
Electric cables, boxes, &c.—Callender's Cable & Construction Co., Ltd.
Electric cables.—Johnson & Phillips, Ltd.; Siemens Bros. and Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; General Electric Co., Ltd.
Electrification of pump equipment.—Crompton-Parkinson, Ltd.
Table fans.—General Electric Co., Ltd.
Motor-generator set.—General Electric Co., Ltd.
Heterodyne units.—Radio Instruments, Ltd.
Motor and control gear.—Laurence Scott & Co.
Electric bakery plant.—General Electric Co., Ltd.
Resistances.—H. W. Sullivan, Ltd.
Submersible pumps.—Drysdale & Co., Ltd.; J. S. White and Co., Ltd.
Automatic starters, &c.—Watford Electric & Mfg. Co., Ltd.; Brookhirst Switchgear, Ltd.
Switches and sockets.—Edison Swan Electric Co., Ltd.
Transformers.—British Thomson-Houston Co., Ltd.; Foster Engineering Co., Ltd.; Ferranti, Ltd.; English Electric Co., Ltd.
X-ray machines.—A. E. Dean & Co.

War Office.

Electric cable.—Callender's Cable & Construction Co., Ltd.
Electric crane.—Isles, Ltd.
Crucibles.—Morgan Crucible Co., Ltd.
Electrification of cranes.—J. Carrick & Sons, Ltd.
Generating sets.—Davey, Paxman & Co., Ltd.; Newton Bros. (Derby), Ltd.
Wireless telegraph sets.—Newton Bros. (Derby), Ltd.

Air Ministry.

Generating set (Calafrana, Malta).—Mirrlees, Bickerton and Day, Ltd.

Post Office.

Band conveyors, Mount Pleasant sorting office.—A. Sauvee and Co. Sub-contractors: Veritys, Ltd., for motors; Johnson, Clapham & Morris for motor enclosures.
Battery, Glasgow Central Exchange.—Chloride Electrical Storage Co., Ltd.
Manufacture, supply, drawing-in and jointing cable.—Brighton-Hastings (Uckfield and Seaford Spurs), Standard Telephones & Cables, Ltd. Clapham Common (Camberley-Bracknell), Siemens Bros. & Co., Ltd.
Telephone Exchange equipment.—Ilford: Siemens Bros. and Co., Ltd. Sub-contractors, English Electric Co., Ltd., for charging machines; Crompton-Parkinson, Ltd., for ringing machines; Chloride Electrical Storage Co., Ltd., for batteries. Weymouth and Haywards Heath: Siemens Bros. & Co. Ltd. Godalming: Ericsson Telephones, Ltd. Moseley: Standard Telephones & Cables, Ltd. Sub-contractors, Electric Construction Co., Ltd., for charging machines; Crompton-Parkinson, Ltd., for ringing machines; Chloride Electrical Storage Co., Ltd., for batteries. Chiswick, Oxford and Queen's Park (Glasgow): Standard Telephones & Cables, Ltd. Edgware: General Electric Co., Ltd. Sub-contractors, Crompton-Parkinson, Ltd., for machines; Chloride Electrical Storage Co., Ltd., for batteries. Waterloo (Liverpool), South Shields, and Weybridge: General Electric Co., Ltd. Leeds and Primrose Hill: Automatic Telephone Mfg. Co., Ltd. Sub-contractors: Newton Bros. (Derby), Ltd., for machines; Alton Battery Co., Ltd., for batteries. Gosport and Portsmouth: Automatic Telephone Mfg. Co., Ltd. W. Kingham & Sons (Reading), Huntley and Palmers (Reading): Relay Automatic Telephone Co., Ltd.
Telegraph apparatus.—Walters Electrical Mfg. Co., Ltd.
Telephone apparatus.—Automatic Telephone Mfg. Co., Ltd.; Dubilier Condenser Co. (1925), Ltd.; Ericsson Telephones, Ltd.; International Electric Co., Ltd.; Peel-Conner Telephone Works (General Electric Co., Ltd.); Phœnix Telephone & Electric Works, Ltd.; Siemens Bros. Co., Ltd.
Testing apparatus.—Automatic Telephone Mfg. Co., Ltd.
Battery stores.—Alton Battery Co., Ltd.; Premier Accumulator Co. (1921), Ltd.
Cable (various).—British Insulated Cables; Callender's Cable & Construction Co., Ltd.; Connollys (Blackley), Ltd.; Enfield Cable Works, Ltd.; W. T. Glover and Co., Ltd.; Hackbridge Cable Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Johnson & Phillips, Ltd.; Pirelli-General Cable Works, Ltd.; Siemens Bros. & Co., Ltd.; Standard Telephones & Cables, Ltd.; Union Cable Co., Ltd.
Lamp caps.—B. W. Johnson.
Joint box castings.—United Steel Co., Ltd. (T. Butlin and Co. Branch).
Loading coils.—General Electric Co., Ltd.
Compound.—W. H. Keys, Ltd.
Cords for telephones.—L.P.S. Electrical Co., Ltd.; Phœnix Telephone & Electric Works, Ltd.; Standard Telephones & Cables, Ltd.
Ducts.—Hepworth Iron Co., Ltd.
Insulators.—J. Bourne & Sons, Ltd.; Litholite Insulators, Ltd.; De la Rue & Co., Ltd.; Taylor, Tunnicliff and Co., Ltd.
Lamps.—General Electric Co., Ltd.
Mouthpieces.—Siemens Bros. & Co., Ltd.
Odometers.—H. Miller & Co.
Wallboards.—Venesta, Ltd.
G.I. wire.—Rylands Bros., Ltd.

Crown Agents for the Colonies.

Cables.—W. T. Glover & Co., Ltd.; St. Helens Cable and Rubber Co., Ltd.
Generating plant.—Metropolitan-Vickers Electrical Co., Ltd.
Signal material.—British Power Railway Signal Co., Ltd.
Static transformers.—Brush Electrical Engineering Co., Ltd.
Sub-station equipment.—British Thomson-Houston Co., Ltd.
Switchgear.—General Electric Co., Ltd.
Telephone switchboards.—Ericsson Telephones, Ltd.
Telegraph ironwork.—Bullers, Ltd.
Train-lighting spares.—J. Stone & Co., Ltd.

Grange-over-Sands.—Urban Council. Accepted:—

Distributing mains (£3,398).—Collier & Co.

Kilmarnock.—

Electric lighting installation at the Grand Hall.—W. Dow and Sons.

Leamington.—Sewage Committee. Recommended:—

Electrical generator, &c. (£1,338).—Belliss & Morcom, Ltd.
Electric lighting plant at Heathcote works (£149).—Midland Electric Light and Power Co., Ltd.

Leeds.—Tramways Committee. Accepted:—
Two 500-kW rotary convertors and transformers for Bramley sub-station (£3,895).—Crompton & Co., Ltd.

London.—BATTERSEA.—Finance Committee. Accepted:—
Installation of electric clock system at Southlands College.—Synchronome Co., Ltd.
HAMMERSMITH.—Electricity Committee.
L.p. distribution boards for Old Oak Estate sub-station (£54).—W. Lucy & Co., Ltd. (accepted).
L.p. fuseboard (£325).—General Electric Co., Ltd. (recommended).

Midlothian.—Education Authority. Accepted:—
Installation of electric lighting at Pumpherston schoolhouse.—Cole & Co. (Edinburgh).

Pershore.—Urban District Council. Accepted:—
Installation of electric lighting at the Sanatorium and at the Highway Depôt.—Abell & Smith.
Electric pump for the Sanatorium.—Booth & Bomford.

Portsmouth.—Electricity Committee. Switchgear:—

Metropolitan-Vickers Electrical Co., Ltd. (Accepted.)	**£291**
Johnson & Phillips, Ltd.	301
General Electric Co., Ltd.	335
English Electric Co., Ltd.	406

Preston.—Electricity Committee. Accepted:—
Boiler-house plant for Ribble power station (£30,500).—Babcock & Wilcox, Ltd.

South Africa.—CAPE TOWN.—Electricity Committee. Accepted:—
One thousand 30 ft. poles and wrought iron tubes (£4,997).—Hubert Davies & Co., Ltd.
500 galvanised stay rods (£260).—General Engineering Co.
500 fuse carriers (£92).—Dowson, Dobson & Behr, Ltd.
Wire crossarms (£723).—Alberyvaux, Ltd.
Osram lamps (£1,238).—British General Electric Co., Ltd.
Soot blowing equipment (£554).—Babcock & Wilcox, Ltd. (Recommended.)

Tilbury.—Urban Council. Accepted:—
Electric cookers (£9 14s. 6d. each).—General Electric Co., Ltd.

Forthcoming Events.

Junior Institution of Engineers.—Friday, November 25th. 39, Victoria Street, S.W. 7.30 p.m. "A Talk About Pioneers in High-Pressure Steam." Mr. L. P. Perkins.
December 2nd. 7.30 p.m. Informal meeting.

National Institute of Industrial Pyschology.—Friday, November 25th. Royal Society of Arts, 5.30 p.m. "How Pyschology Enters into the Institute's Factory Investigations."

Institution of Engineering Inspection.—Friday, November 25th. Royal Society of Arts. 7.30 p.m. "Elutriation as an Aid to Engineering Inspection." Mr. L. Andrews.

Physical Society.—Friday, November 25th. Imperial College of Science, South Kensington, S.W. 5 p.m. Ordinary scientific meeting.

Illumination Design Course.—Monday, November 28th. Lighting Service Bureau. 7.30 p.m. "Special Lighting Problems."

Royal Society of Arts.—Monday, November 28th. John Street, Adelphi, W.C. 8 p.m. Cantor Lecture, "Alloy Steels: their Manufacture, Properties and Uses." Prof. C. H. Carpenter, F.R.S. (Lecture III.)

Bedford Scientific and Engineering Society.—Tuesday, November 29th. Newnham Rooms, Bedford. 8 p.m. "The Manufacture of Turbine Blading." Mr. C. E. Davies.

Nottingham Society of Engineers.—Monday, November 28th. "The Law in Relation to Engineers." Mr. J. W. Thomas.
Friday, December 2nd. Victoria Station Hotel. 7.30 p.m. Annual dinner.

Royal Institution of Great Britain.—Tuesday, November 29th. Albemarle Street, W. 5.15 p.m. "A Year's Work in X-Ray Crystal Analysis." Sir W. Bragg, F.R.S.

Electrical Power Engineers' Association (Sheffield Section). Wednesday, November 30th. Royal Victoria Hotel.—Annual meeting. Address by Mr. J. W. Thomas.

Overhead Lines Association.—Wednesday, November 30th. Institution of Electrical Engineers, London, W.C. 5.30 p.m. Discussion on "Regulations."

University College, London.—Wednesday, November 30th. 5 p.m. Presentation of his portrait to Prof. J. A. Fleming, F.R.S.

Electrical Association for Women.—Wednesday, November 30th. Lighting Service Bureau, 15, Savoy Street, W.C. 7 p.m. "Simple Household Repairs." Miss M. Partridge.
Thursday, December 1st. 3 p.m. "Colour Lighting for Home Decoration." Mr. L. E. Buckell.

Institution of Electrical Engineers.—Thursday, December 1st. Institution, London, W.C. 6 p.m. "Electric Ploughing." Mr. R. Borlase Matthews.

(Mersey and North Wales (Liverpool) Centre).—Wednesday, November 30th. University Club, Liverpool. Annual dinner.

(North-Eastern Centre).—Monday, November 28th. Armstrong College, Newcastle-on-Tyne. 7 p.m. "Apparatus Standards of Telephonic Transmission, and the Technique of Testing Microphones and Receivers." Mr. B. S. Cohen.

(North-Midland Centre).—Tuesday, November 29th. Hotel Metropole, Leeds. 7.15 p.m. "Oil-Electric Automatic Control of a Hydro-Extractor." Mr. J. V. Levett; and "The Contractor's Place in the Industry." Mr. H. Moss.

(North-Western Centre).—Tuesday, November 29th. Engineers' Club, Manchester. 7 p.m. "Higher Steam Pressures and their Application to the Steam Turbine." Messrs. A. H. Law and J. P. Chittenden.

(North-Western Students' Section). — Saturday, December 3rd. College of Technology, Manchester. 7 p.m. Dance.

(Scottish Centre). —Tuesday, November 29th. Grosvenor Restaurant, Glasgow. 6 for 6.30 p.m. Annual dinner and dance.

(South-Midland Centre).—Friday, November 25th. Grand Hotel, Birmingham. Annual dinner.
Wednesday, November 30th. 7 p.m. University, Birmingham. "Battery Eliminators." Messrs. P. R. Coursey and H. Andrewes.

Notes.

E.A.W. Activities.

A lecture demonstration on electric cooking was given by Miss E. Roffe, electrical cooking demonstrator to the Cardiff Corporation, before the South Wales and Monmouthshire branch of the Electrical Association for Women on November 17th.

On November 16th, at the E.L.M.A. Lighting Service Bureau, London, a discussion on the "Care and Maintenance of Electrical Apparatus" was opened by Miss Gladys Sharp, who mentioned that on a.c. supply she had experienced trouble with loose connections. She suggested that manufacturers might put spring washers or lock-nuts on all heating apparatus. With portable apparatus the chief trouble was the breaking of the flexible wire at the connections, and mention was made of a non-kinkable flexible cord.

B.E.S.A. Publication.

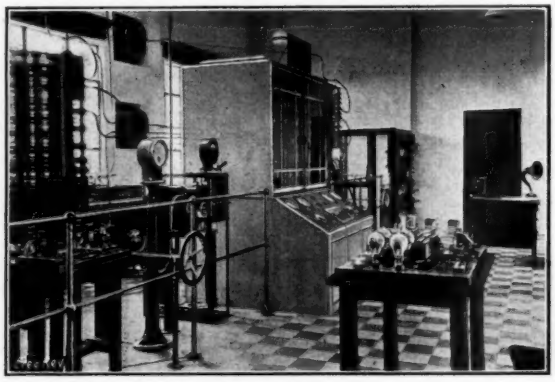
A recently issued publication of the British Engineering Standards Association, No. 269—1927, British Standard Rules for Methods of Declaring Efficiency of Electrical Machinery, provides a method of predicting and declaring the efficiency of a machine by which the results determined correspond closely with the time efficiency which might be determined eventually on the completed machine. The use of nominal efficiencies (which omit allowances for stray load and other losses) is considered misleading, and is not recognised in the Rules, which do not apply to traction motors. It is pointed out that the verification of the efficiency of electrical machinery by direct measurement of input and output is unreliable, except when the efficiency is comparatively low, since any errors in measurement cause relatively great errors in the value of the efficiency obtained. The verification of the efficiency by measuring the losses and making due allowances for stray load losses (summation-of-losses method) gives greater accuracy, since an error in the value of the losses causes only a relatively small error in the value of the efficiency obtained. A specification for the methods of verifying efficiency is under consideration; in the meantime, should any question as to the efficiency arise at the time of the acceptance of the machine, the efficiency should be checked in accordance with the method of declaration specified in the Rules. Apart from its usefulness to the practical engineer, this publication should prove of value to students and others, as it is a comprehensive treatise on the whole question of the efficiency of electrical machinery. The section on definitions is in itself a very useful feature from the student's point of view, apart from the concise schedules of the losses occurring in various types of electrical machines. It is of interest to note that these Rules have been accepted by the International Electrotechnical Commission as the basis for an international volume of Rules on the same subject. Copies of the publication may be obtained from the Publications Department, British Engineering Standards Association, 28, Victoria Street, London, S.W.1, price 2s. 2d., post free.

Electricity and Gas Generation.

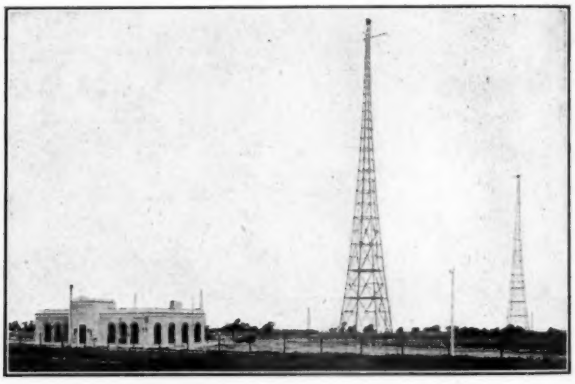
In a paper dealing with the efficiencies of gas and electric power generation, by Mr. L. E. Jeffrey, B.Sc., read before the Junior Institution of Engineers, reference is made to the prospect of the amalgamation of gas and electricity undertakings from the generation point of view. From the gas works standpoint it is very desirable that an electricity undertaking using either coke or gas for steam-raising purposes should be attached to the works, and thus provide a ready market for these commodities; but the fuel used at present by electricity undertakings is of very inferior quality and its market value is much lower than that of gas coke. It is true that in some cases it would be economically possible to use coke breeze as a fuel for electricity generation, but it is questionable whether the total output of coke breeze is sufficient to meet the demands of the electricity supply industry. Again, from the coal-conservation standpoint, it is doubtful whether the use of gas-fired boilers would result in any saving, for the type of fuel used by the electricity undertakings would hardly be suitable for carbonising in gas retorts. The electrical industry, therefore, is serving a national purpose in consuming the low-grade fuels produced from the collieries, and the introduction of pulverised fuel is assisting materially in this direction. Further, the efficiency of the boiler house is relatively high, and the main loss of efficiency in the generation of electricity is not in this section of the plant.

The Lima Wireless Station.

The accompanying illustrations are views of the Lima, Peru, high-speed wireless telegraph station (call signal OAZ), which was opened in July by the President of Peru, Señor Don Augusto B. Leguia. It utilises a 15-kW valve transmitter, and was built by Marconi's Wireless Telegraph Co., Ltd., to replace the old San Cristobal station, and is part of the scheme



Interior Equipment.



The Lima Station and Masts.

of modernisation of the Peruvian postal, telegraph and wireless services, which are operated by Marconi's Co. The station will be used at present for internal communication in Peru. The first picture shows (from left to right) the closed-circuit tuning inductance, main oscillator panel, and aerial-tuning inductance; the loud-speaker visible on the table enables the engineer to check the steadiness of the signals. The second picture illustrates the station building and aerial masts.

H.p. Cables.

At a largely attended meeting of the Birmingham Electric Club on October 26th, Mr. T. N. Riley, M.Sc. (Tech.), of Messrs. Standard Telephones and Cables, Ltd., delivered an illustrated lecture on "The High Voltage Cable Problem." For cables up to 11,000 V working pressure, the lecturer said, the maximum electrical stresses in the dielectric had been comparatively low, and major importance had been given to mechanical considerations. For over 25,000 V the stresses had been increased to such an extent, in building the cables of practical dimensions, that they were of first importance; but they were not even now very high, compared with the ultimate breakdown strength of the dielectric when tested in a direction normal to that of the laminations, and methods of construction which aimed only at reducing the electrical stress offered no satisfactory solution of the troubles which had been experienced. Two factors appeared to be of chief importance in the causes of breakdown; the formation of voids in the dielectric, and the marked increase of tangential stresses causing leakage currents along the laminations, which produced a heating effect. In dealing with the problems of eliminating these defects, he pointed out the desirability of limiting the maximum temperature to 50 deg. C., rather than to 65 deg. C. The use of paper and compounds of suitable types was a highly important matter, and tests were quoted illustrating this. Mr. Riley urged the necessity of incorporating within the structure of the cable a reservoir, not under stress, which would serve to feed the dielectric. In the case of cables for very high voltages, this had been done by the use of a hollow conductor, but the use of a thin oil and reservoirs situated at intervals led to structural difficulties and increased cost. In a three-core Höchstadter cable the wormings could be made to serve this purpose, but in a single-core cable it was desirable to have special reservoir sections. Two methods of factory testing had been advocated, the limiting-pressure method, in which, if the low connecting life and test pressure were known, a short period excess pressure test on a sample would indicate the probable life at working pressure, and the one concerned with the change of power factor with voltage after a heat run to the working temperature. The objections to the first method were that the law was not definitely known, and that wide variations in it occurred between the products of various manufacturers and with different materials.

Temper-Brittleness Investigations.

In a paper on "Magnetic and Other Changes Concerned in the Temper-Brittleness of Nickel-Chromium Steels," read before the Iron and Steel Institute by H. A. Dickie, B.Sc., an account is given of experiments carried out to discover how the magnetic properties, the specific electrical resistance, the specific volume, and the hardness of highly susceptible nickel-chromium steels are affected by various tempering treatments. The results show that the magnetic properties are modified by cooling the steels slowly from the tempering temperature, and that the magnetic state of the intermediate condition is similar to that of the brittle condition. These facts, together with a consideration of the manner in which the magnetic properties change on slow-cooling, give strong support to the view that temper-brittleness is connected with the solution and redeposition of carbide. The rise in remanence accompanied by a rise in maximum permeability and a small decrease in coercive force and in hysteresis loss are features which would be expected to characterise deposition from solid solution on slow-cooling. The fall in resistivity would similarly be expected. Thus, at the tempering temperature, some carbide is held in solution in ferrite, and is retained on quenching from that temperature, but separates out on slow-cooling. The double effect in specific volume and in hardness has already been fully discussed, and need not be enlarged upon here. When a steel susceptible to temper-brittleness is cooled slowly from a high tempering temperature, a portion of the carbide, which exists at that temperature in solid solution in the ferrite of the steel, separates out, giving definite modifications of magnetic properties and specific resistance. This also results, at moderate cooling rates, in contraction and softening, as shown by specific volume and hardness tests. When, however, the rate of cooling is extremely slow, the steel expands and hardens again—relatively to the moderately cooled state—and this is evidently due to the formation of a network of carbide round the grains, producing, by its predominant effect on the coefficient of contraction and its influence in increasing the resistance to penetration, an increase in specific volume and in hardness respectively. Deposition of carbide from solid solution will not, in itself, induce brittleness in the steel. It is only when the rate of cooling is sufficiently slow to allow of expulsion of the carbide to the grain boundaries that brittleness develops.

Rural Electricity Supply.

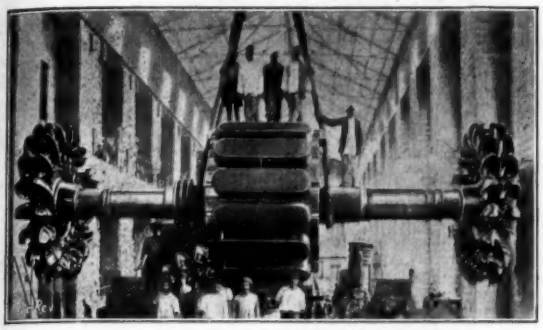
The political correspondent of the *Daily Mail* announces that this week the Minister of Transport, Col. Wilfrid Ashley, held a conference with representatives of rural areas to consider how electricity can be made available to rural residents at low rates. It is probable that a decision may be taken to select typical areas for application of a scheme in order to see how it works out in practice.

Industrial Museum.

At the Home Office Industrial Museum, Horseferry Road, Westminster, S.W., the official opening of which took place on November 21st, one of the largest exhibits is that of Messrs. Hopkinsons, Ltd., who show a full-size Lancashire boiler-front and a range of h.p. valves and pipes, in addition to various other boiler auxiliaries.

An All-British 150,000-h.p. Hydro-Electric Station.

The Bhira (India) power station of the Tata Power Company, which will be the principal source of the electricity supplied to Bombay and the surrounding district, is now nearly completed. This important station, which has been brought into being largely through the enterprise of Mr. H. P. Gibbs, of the Tata Power Company, is being equipped with five



Water Turbine Rotor for India.

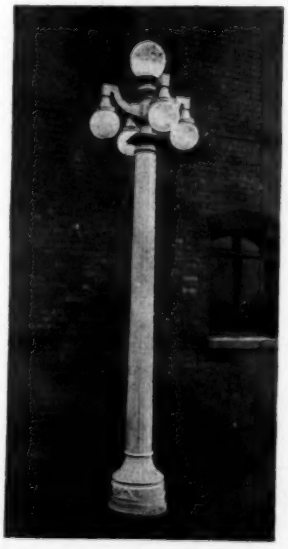
30,000-h.p. twin impulse turbine units, built by the English Electric Co., Ltd., at its Rugby and Stafford Works. The accompanying illustration depicts a scene during the erection of one of these sets, and gives a general idea of the size of the rotating parts. The one-piece shaft, together with the alternator rotor and the two bucket wheels, have a total weight of approximately 80 tons.

The Röntgen Society and British Institute of Radiology.

The fusion of the Röntgen Society with the British Institute of Radiology is now complete, and the session 1927-28 will be the first of the reconstituted body. The Councils of the two Societies decided that the first (November) meeting should be of a somewhat special character in order to mark fittingly the commencement of a new era in the history of radiological organisation in this country; the meeting was arranged to occupy two days (November 17th and 18th) in conjunction with an exhibition of apparatus, the reading of papers, a dinner, &c. Sir Humphry Rolleston was elected president, and in the course of his presidential address said that, although the medical applications of radiology were most important, its broader bearing on industry, the arts, and sciences, especially physics and biology in its widest sense, could not be too much emphasised. The Society of Radiographers became affiliated to the Institute at the beginning of the present year. It was announced that the Röntgen medal of the Society had been awarded to Mr. R. G. Cantie.

Street Lighting in New Zealand.

The fluted cast-iron street lighting column illustrated below is one of a number that have recently been supplied by the General Electric Co., Ltd., for an important street-lighting



A Handsome G.E.C. Street Lighting Standard.

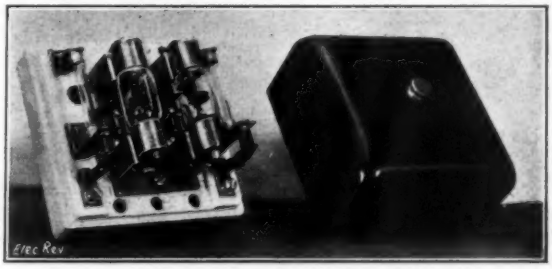
scheme in New Zealand. It is fitted with a five-light bracket arm supporting four 10-in. diameter frosted globes on the side arms, surmounted by a 12-in. diameter central globe. The height to the top of the centre globe from the ground level is 13 ft.

An Aluminium Tramcar.

According to the *American Metal Market* the Cleveland Railway Co. has been operating an aluminium car since 1926, which is about 30 per cent. lighter than steel cars of the same design. It is operated at a power saving of more than 20 per cent., with proportionate savings in maintenance and wear on the tracks. The operating cost per car for power alone is $500 a year less than for the old heavy type of street car. In medium-sized cities operating between 300 and 1,000 cars this power saving would increase the earnings from $150,000 to $500,000 a year, making the difference between profit and loss for some companies. Another advantage of the aluminium car is that it can make quicker stops from high speed and faster starts. A feature of the Cleveland car is its individual 'bus-type seating equipment. Practically all the motor-'bus manufacturers have made wide use of aluminium in their latest models, and one engineer claims to be able to get equal strength from aluminium with less than half the weight of any other metal.

Vacuum Lightning Arrestors.

The inherent unreliability of the common types of spark-gap arrestors employed to protect telephone, telegraph, and other weak-current apparatus is well known to all engineers who have had occasion to employ them. Their disadvantages may be briefly summarised as follows:—(1) Operation is unreliable, and generally occurs at too high a voltage; (2) the electrodes often become welded together after operation, necessitating renewal before working can be resumed; and (3) the very small gap necessary leads to low insulation due to dampness, dust, insects, &c., lodging in it. An arrestor that is free from these defects is the vacuum pattern, which consists of a pair of specially designed electrodes in a hermetically-sealed glass container, arranged for mounting in a spring-clip holder. The enclosure of the electrodes in a partial vacuum not only permits them to be comparatively widely



A Vacuum Telephone Protector.

separated, but also ensures reliable and uniform operation at about 300 volts. The large gap prevents the electrodes becoming welded together after operation and, being hermetically sealed, they are dust-, damp- and insect-proof. Although the first cost is a little higher than that of the usual saw-tooth and carbon-block arrestors, considerable economy can often be effected by the use of arrestors of this type, due not only to the decreased maintenance costs, but also to the freedom from interruption of service they afford. This applies particularly to those cases of breakdown of the service that result in a corresponding loss of revenue. The fact that their high insulation cannot be diminished by the accumulation of foreign matter makes them extremely useful in tropical climates. To make them suitable for use with all kinds of apparatus, many different types of mountings are available to accommodate arrestors only, or in conjunction with heat coils and fuses. The above illustration shows a telephone instrument protector, complete with fuses and heat coils, which has recently been developed for a foreign Government Department. The patentees and manufacturers are Messrs. Siemens Brothers & Company, Ltd.

Modern Cement Plant.

In a recent paper on the above subject before the Institution of Mechanical Engineers, Mr. Hal Gutteridge surveyed the processes that take place in the manufacture of Portland cement, and considered in detail the individual units of a modern plant. He pointed out that owing to the scattered nature of the units requiring power in cement works, it is the universal practice to employ electricity for the distribution of the energy, which is more economical than any other form of power possible, owing to its ease of transmission to distant points; it also has the advantage that the power taken by each motor can be accurately measured and any irregularities readily indicated. Alternating current, of either 25 or 50 cycle, three-phase, is generally used, particularly when the total power is large and permits of the employment of turbo-alternators. If the mill is provided with its own power house, there is the choice between high pressure (say, 2,000 to 6,600 volts) for the large power motors with transformers to reduce the pressure to 440 volts for the numerous small motors, or a low pressure (440 volts) throughout the works. When an external source of supply is used, it is possible to consider the voltage of supply for each motor on its merits; the supply would probably be taken at 6,600 volts, but sometimes at 3,300

volts; the larger motors of 500 h.p. for the grinding mills and other heavy duties would be wound for the h.p. supply and transformers would be installed to reduce the pressure to 440 volts for the numerous small motors. Which motors should be wound for the high pressure and which for the low resolves itself into a question of finance, and much will depend on the individual motors and the method of grouping; generally speaking, it is not economical to install motors wound for high pressures unless they have an output of from at least 150 to 200 h.p. Practically all the motors in cement works, except those of the smallest sizes, require a high starting torque. Kilns and mills of all descriptions possess a great amount of inertia and friction, which call for at least twice the full-load working torque. For slurry pumps, conveyors, elevators, mixers, sack-drying plant, squirrel-cage motors are usually installed, as their one-third load starting torque (with star-delta starters) is sufficient for the running torque. The slip-ring motor has a higher starting torque, but in small sizes it is much more expensive than the squirrel-cage type; if efficiency and power factor are not held highly to account, there is a lot to be said in favour of the slip-ring motor. It is a wise precaution so to arrange the horse-power of the motors as to have as many as possible of the same power, so that the minimum of spares need be carried.

As there is always a certain amount of cement dust in the atmosphere, it is desirable to use so far as is possible switchgear of the oil-immersed type. For controlling the starters of slip-ring motors, oil-immersed switches with overload releases meet the case; while for squirrel-cage motors, oil-immersed star-delta starters with a complete "off" position are suitable. All motor-starting equipment should be fitted with adequate overload and no-volt releases. The electrical energy required is between 65 and 100 kWh per ton of cement; therefore, a factory producing 100,000 tons of cement per annum would require from 6.5 to 10 million kWh per annum. If the raw materials are hard, the power absorbed in their grinding may be as much as 35 per cent. of the total power required by the whole plant. The clinker-grinding mills may take another 45 per cent., leaving only 20 per cent. for all other units. The following list will roughly indicate where the power is absorbed in a mill using hard raw materials:—

Department.	Per cent.
Crushing	6
Grinding	33
Kilns	5
Coal mill	11
Clinker mills	41
Miscellaneous	5

In a mill using soft chalk and clay, the power required per ton may be 20 per cent. less than in a mill using hard raw materials.

The Great Electrical Hare Competition.

The dogs left in the contest for the final heat are:—Monach, 10; and Tricky Tricity, 48. The total number of hares caught to date is 7,017.

Automatic Telephones in Brighton.

The Brighton and Hove telephone area was converted at midnight on November 12th, when seven old manual exchanges were superseded by five new automatic ones; another manual exchange (Southwick) will shortly be replaced by automatic equipment, and the area will then comprise the following:—

Brighton Central ...	4,400 lines	
Hove	4,000 ,,	
Rottingdean	130 ,,	Satellites of Central
Portslade	400 ,,	Satellites of Central
Southwick	130 ,,	Satellites of Hove
Preston	960 ,,	Satellites of Hove

In addition, a new manual exchange deals with traffic outside the area, inquiries, call offices, &c.; it has a 23-position manual board and a 6-position monitor's desk. All of the new equipment was made and installed by Siemens Bros. and Co., Ltd., Woolwich, being of their No. 16 pattern, the special features of which system, including the discriminating repeaters at satellite exchanges, have already been described with reference to the Edinburgh and Sheffield transfers (see Elec. Rev., November 12th, 1926, and March 25th, 1927, respectively). Of certain additional points of interest of the Brighton system, one is in connection with the Southwick and Rottingdean exchanges, which have no permanent maintenance staff in attendance; faults are automatically signalled to Central, the signals showing either that the fault is interrupting service, and, therefore, requires immediate attention, or that it is not urgent and can wait until a convenient time. A noteworthy innovation is to be found on the subscribers' telephones, the dial switches of the instruments showing the full names of the exchanges in the area, in addition to the usual figures 1 to 0. All subscribers appear in the directory under the name of an exchange and a 4-figure number; when calling another subscriber, callers must first dial the exchange name, followed by the necessary figures. The name is, of course, really an extra digit, and is perhaps easier for subscribers to remember than if 5-figure numbers had been used throughout. The Post Office has provided new premises for each of the automatic exchanges.

Late Legal.

Damages for Wrongful Dismissal.—In the Kings's Bench Division, on November 22nd, Col. Eric Ball, Blackheath, brought an action against Burndept, Ltd., for damages for wrongful dismissal. The company was not represented. The plaintiff stated that he was formerly sales manager at a salary of £1,200 per annum. The Lord Chief Justice, who sat with a special jury, awarded him £2,000.

Loud-Speaker Directors' Dispute.—A motion in which the Marquis Gonzales de Andia Yrarrazaval and Mr. J. C. Brinton were plaintiffs, and Mr. Gilbert R. Willans, Lord Redesdale, and Commander G. T. Bowles were defendants, was before Mr. Justice Romer in the Chancery Division on November 18th.

Mr. Stable, for the plaintiffs, said he asked for an injunction restraining Mr. Willans from acting as director of Artandia, Ltd., manufacturers of wireless loud-speakers, on the ground that he had been wrongly appointed.

Mr. Wilfred Hunt, for the defendants, applied for an adjournment to file evidence, and said he would give an undertaking that Mr. Willans would not interfere with a forthcoming exhibition of these loud-speakers. There was no doubt that Lord Redesdale and Commander Bowles were directors, but there was a question as to Messrs. Brinton and Willans.

Mr. Stable accepted the undertaking, and the motion was adjourned for a week.

Mr. Hunt mentioned that there was another action, in which Lord Redesdale and Commander Bowles were plaintiffs and the Marquis the defendant, for an injunction restraining the latter from exercising his voting power with a view to removing the plaintiffs from the board.

The Overhead Lines Association.

At the meeting which is to be held at the Institution of Electrical Engineers, London, on Wednesday, November 30th, at 5.30 p.m., Mr. W. Fennell, M.I.E.E., will open the discussion on "British Regulations." Subsequent meetings will be held at the same place and hour on Wednesdays:—January 11th, 1928: "French Regulations," by Major Theodore Rich, O.B.E., A.M.I.E.E. February 8th, 1928: "Joint Use of One Wood Pole Line for Electricity, Telephone and Telegraph Wires," by Mr. E. S. Byng, M.I.E.E.

Motor-Generator Locomotives.

Much interest is attached to both the new tunnel through the Cascade Mountains and the extended electrification which is being made by the Great Northern Railway in that region of America, and amongst the new developments the two motor-generator type locomotives, which have recently been built, supply their quota of interest. Possessing extreme flexibility of control, the locomotives will be used in both freight and passenger service between Skykomish (Wash.) and the present Cascade tunnel, a distance of 24.6 miles; they will then be operated between Skykomish and Wenatchee. When electrified, this route will be about 72 miles in length and will include the new 7¼-mile tunnel and a new cut-off which will reduce the larger part of the present maximum grade of 2.2 per cent. to 1.6 per cent. According to the *General Electric Review*, they are the largest single-unit motor-generator type locomotives that have yet been built. Of the geared-motor type, the converting apparatus and cab are mounted on a cab-underframe, which in turn is supported through two centre plates on two trucks. The trucks are articulated and each has three driving axles with an extension of the truck resting on a single-axle radius-bar guiding truck. Single-phase power is obtained from the trolley at 11,000 volts, 25 cycles, and is transformed to 2,300 volts. A synchronous motor operated at 2,300 volts drives, through a flexible coupling, two direct-current generators which are connected in series and supply d.c. at 1,500 volts to the traction motors. The speed of the locomotive is chiefly controlled by varying the voltage of the generators, additional speed being obtained by two field-shunting positions. The data in the following table indicate the general features of the design of the locomotive:—

Tractive effort, one-hour rating	multiple-unit
Horse power, one-hour rating	67,200 lb.
Speed at one-hour rating, full field ...	3,300 r.p.m.
Tractive effort at 30 per cent. coefficient of adhesion	18.2 m.p.h 120,600 lb.
Voltage of each of main generator (d.c.) ...	750
Voltage of starting motor (d.c.)	120
Voltage of main exciter (d.c.)	65
Type of control (non-automatic) ...	Electro-pneumatic

An air-blast transformer is used to transform the current collected at the trolley from 11,000 to 2,300 volts; two blowers, each driven by a single-phase repulsion motor, supply air to the transformer.

The motor-generator set is comprised of five units mounted on two shafts, three units being mounted on one shaft and two on the other; the two shafts are coupled together by means of a "Fast" flexible coupling which allows for angular and offset misalignment: (1) a synchronous motor operating at 2,300 volts and having three-phase stator windings, though designed for single-phase operation; the shaft is mounted on two bearings, an extension of the shaft carrying the main exciter. (2) A 65-volt direct-current exciter that supplies the control current, the excitation for the main generators and regenerative braking exciter, and battery-charging current;

this exciter is overhung on the shaft of the synchronous motor. (3) Two 750-volt generators connected in series and supplying current to three groups of traction motors, each group of which consists of two motors connected in series; the magnet frames of these two generators are bolted together; and both armatures are mounted on a single shaft carried by two bearings. An extension of this shaft carries the combined starting-motor and regenerative exciter. (4) A combined starting motor and regenerative exciter that is used as a single-phase series motor in order to start the motor-generator set, or as a direct-current generator to excite the fields of the traction motors during regeneration. In order to start the motor-generator set it is only necessary for the engineman to press a button situated within easy reach; the synchronous motor then synchronises automatically in one minute, with normal voltage on the trolley. The forced-ventilated, railway-type motors are geared to the six driving axles.

A Phase-Balance Instrument.

A German firm has recently introduced a little instrument, the "Blindlast Asymmeter," for indicating the phase conditions in a three-phase distribution system. Hitherto, to obtain such records three separate instruments have generally been employed, necessitating considerable calculation to arrive at the state of balance obtaining in the system. In the new instrument, which is made in various types, one for recording the pressures to earth, one for the effective loadings, and another for the power factor, no calculations are necessary, a direct reading being at all times available. In order to obtain a simultaneous three-fold record, the usual linear scale type of recorder has been abandoned in favour of an equilateral triangular scale, with 100-mm. sides, of which the

Switchboard "Asymmeter."

three intersecting points represent the three phases, and the area is divided by nine circles arranged concentrically with, and equally spaced from, the centre of the triangle. The angles are determined by means of radial lines every 30 deg. The illustration shows the scale combined with an instrument for use on switchboards to indicate the pressure of the system to earth. A small disk, 6 mm. in diameter, of a shiny red colour and suspended by means of three fine silk threads, is used as the indicating point. The threads are connected with the three phases within the instrument in such a way that when the system is balanced the disk is suspended directly in the centre of the co-ordinates; when any variation in the phases takes place the disk moves from the centre towards the point which forms the geometrical centre of gravity for the new state of balance created by the asymmetry; that is to say, it moves towards the intersection of the triangle representing the phase with the greatest pressure. Usually the instrument is adjusted so that the disk operates when the conductor pressure rises to 50 per cent. above the maximum. When a drop occurs in two phases the disk takes up a position towards the middle of the line between the respective phase intersection points. The makers do not claim that the instrument furnishes other than a relative indication of the condition of the phases. They state, however, that if a number of the pressure asymmeters are used for indicating an earth loss, the nearest instrument will give the truest indication, so that the instruments should be useful in tracing faults of this description. The instrument can be used on conductors carrying 5 A at 200 V.

The Application of Electric Motors to Machine Tools.

According to Mr. R. C. Deale, quoted in the *American Machinist*, manufacturers and users of machine tools in the United States have been put to great trouble and expense because of the lack of uniformity in the mounting dimensions of electric motors built by different manufacturers. Not only does no uniformity exist, but there seems to be very little attempt at uniformity. This is very much in contrast with the situation in Germany, where the motors built by all manufacturers have the same mounting dimensions. Two large classes of motor mountings exist, and these require two degrees of standardisation. The first comprises those machines in which some flexible type of drive is used between the motor and the machine. In this class of drive the dimensions of the motor-shaft extension are of most importance. Where shaft extensions are not the same, each motor drive must be sent through the shop separately, so that the pulley or sprocket can be machined to fit the motor being used. This naturally delays shipment, as it prevents the use of a standard piece of equipment. It also increases the cost of the machine and requires an individual machine set-up when the bore is being machined.

Holding-down bolts must also be treated separately, as no one size will do for all motors of the same rating. Most holding-down bolts seem to be considerably larger than is necessary to resist the torque of the motor. The extra operations required due to lack of uniformity can easily add a week to the delivery of the machine, and $25 to $50 to its total cost.

In the case of gear drives, the situation is much more serious. Here the shaft extension and holding-down dimensions are just as important as in the previous case. In addition, other dimensions must be considered to ensure that the axis of the motor bears the proper relation to the axis of the motor pinion or driven gear. In a drive of this type it is necessary to make an attachment drawing every time a different motor is used. Motor manufacturers claim that standardisation of dimensions would interfere with their freedom of design, but it is difficult to see any great advantage in slight alterations of shaft diameters or of holding-down bolts.

The difficulties encountered by the machine manufacturer due to lack of interchangeability of motors are passed on to a customer in the form of lengthened shipping dates and increased costs. In addition to this, in any plant where there is a constant flow of production it is not possible to allow a machine to stand idle while repairs are being made to the driving motor. Consequently, it is a practice to remove the motor which has given trouble and to replace it by a spare. With the great variations in mounting dimensions it is difficult to do this. It is impossible to replace the motor of one make by one made by a different manufacturer without considerable contriving. Moreover, the frequent changes in dimensions made by individual manufacturers make it difficult to replace a motor by one built only a short time later.

Appointments Vacant.

Assistant mains engineer for the Municipality of George Town Electricity Supply & Tramway Department. Meter tester, &c., for the Southampton Corporation Electricity Department. Resident electrical engineer (£260) for the Tanfield Urban District Council. Manager (£200) for the Kenfig Hill and District electricity scheme. Chief engineer for the Government of Ceylon's electricity undertakings. (See our advertisement pages to-day.)

A New Electric Hare.

Mr. J. A. McKee, a Belfast motor engineer, has invented a new type of electric hare which is being installed on a new track in Belfast, says the *Evening News*. The hare runs on an underground trolley system instead of on an extended arm as is at present the vogue. Not only is the new apparatus more realistic, but the machine can attain a speed of 60 miles per hour.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

Mr. THOMAS PLUMMER, M.I.E.E., Shrewsbury, on retiring after 42 years' service in the engineering department of the Post Office, has been presented by the superintendents and engineers and the headquarters' staff with a silver rose bowl and silver-mounted tea service. Before going to Shrewsbury in 1912 Mr. Plummer was head of the North Wales district. He has been a member of the Institution of Electrical Engineers for over 30 years.

Mr. W. H. HARRISON has been appointed by Swinton and Pendlebury Urban Council as electricity consumers' engineer. There were 28 applications for the post.

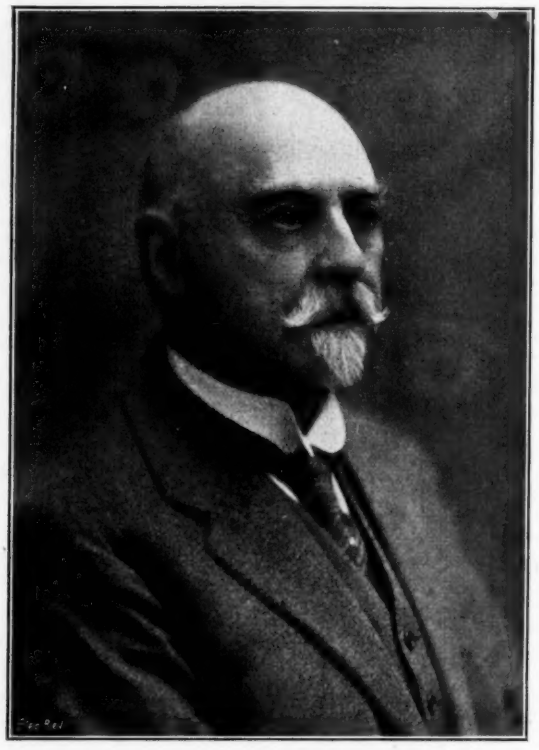
Mr. E. F. KILL landed at Plymouth on November 17th, from the P. & O. liner *Malwa* to take up his appointment as senior electrical engineer at Devonport Dockyard, in succession to Mr. Benham. Mr. Kill has been serving at the dockyard at Hongkong.

Mr. W. RADCLIFFE, of the electrical staff of Lever Bros., Ltd., Port Sunlight, has been appointed senior accountancy clerk in the electrical department of Hackney Corporation.

Mr. BENJAMIN JONES, of Aberbargoed, has been appointed first electrical engineer to the Bedwellty Urban Council.

Mr. SYDNEY W. BAYNES, M.I.E.E., who is retiring from the position of borough electrical engineer of St. Pancras at the end of the year, is an old Cromptonian. In the early days of his career he was the electrical engineer for the Forth Bridge works and later he carried out contracts for the Central Argentine Railway and the Kensington and Knightsbridge Electric Lighting Co. He subsequently entered municipal electricity supply work as chief engineer to the Bradford Corporation and seven years later, in 1895, took up his present position at St. Pancras. He has thus served the Metropolitan Borough for 32 years, and during that time has given untiring

attention to both the technical and commercial sides. His policy has always been one of "cheap units" and the expansion of the St. Pancras undertaking is testimony to the success of his methods; during his period there the profit derived from the undertaking has exceeded £375,000. Mr. Baynes has a great deal of pioneer work to his credit and among this may be mentioned the raising of the consumers' supply pressure to 440 and 220 V, three-wire, d.c.; the adoption of 5,000-V, 50-cycle transmission to sub-stations; the introduction of the "Brush-Ljungström" turbo-generator, and of the "Lopulco"



Elwin Neame] [*London.*

Mr. S. W. Baynes, M.I.E.E.

The retiring chief of the St. Pancras undertaking.

pulverised-fuel system. A remarkable feature of the St. Pancras undertaking is its concentration; in an area of just one acre there is 31,500 kW of generating plant, with coal stocks and buildings. Mr. Baynes's latest achievement was the installation of the largest "Brush-Ljungström" set so far constructed in this country.

M. JACOB, the chief engineer of the French Telegraphs, who has been recently appointed by the French Government to the order of the French Legion of Honour, has had a rapid and remarkable career. Commencing as a clerk in the post and telegraph service in Marseilles so recently as 1907, he studied hard in his spare time and, following the taking of his degree, he was awarded a French Posts and Telegraphs bursary, which enabled him to take a course of study at the Paris Sorbonne. During the war he first served as an infantry lieutenant in the French Army and then as captain in the engineers' section, being awarded the Croix de Guerre for his services, which included, among others, the compilation of a handbook on telephony officially adopted for the use of the infantry, artillery, and engineers of the French army. After the war he was appointed as one of the engineers of the French telegraph service, being promoted to his present position at the commencement of the current year.

Armagh City Council has adopted the recommendation of the Electricity Committee for the appointment of Mr. V. C. HUGHES as electricity manager at a salary of £280 a year.

Mr. J. W. DAWSON, assistant engineer to the Bradford City Tramways Department, is to retire at the end of December, under the Corporation pension scheme, after 22 years' service. Mr. Dawson was associated with Mr. C. J. Spencer in the patenting of the special extensible axle which enabled through electric tramcars to be run between Bradford and Leeds on different gauge tracks.

Mr. W. CHAMBERLAIN, general manager of the Leeds City Tramways, was one of the most indefatigable workers in the successful promotion of a great Leeds convoy of supplies for the assistance of the people of Fleetwood distressed by the recent grievous tidal flood there. The convoy, which left Leeds on November 16th, comprised nearly 50 motor vehicles, with about £2,000 worth of goods, in addition to which there was a sum of £650 which had been collected in money.

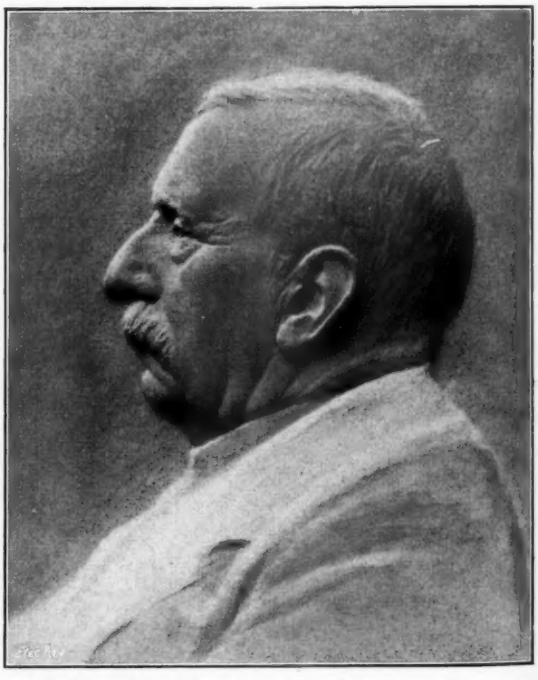
It is stated in the Press that the Secretary of State for India has appointed Mr. C. M. SCOTT to be an Assistant Divisional Engineer in the Posts and Telegraphs Department of the Government of India.

On November 15th Mr. JOHN A. WHITTON retired from the telegraph department, Edinburgh Post Office, under the age limit.

The Colchester Town Council has appointed Miss M. C. F. APPLEBEE, of Ashton-under-Lyne, as electricity showroom attendant.

According to the *South African Mining and Engineering Journal*, the Victoria Falls and Transvaal Power Co., Ltd., announces that Mr. T. G. OTLEY has been appointed to the position of assistant manager and mechanical engineer. He has been associated with the company since it was formed in 1906. Mr. C. L. BRYDEN will in future hold the position of assistant manager and electrical engineer, and Mr. F. MCCARDLE has been appointed assistant manager and chief accountant.

Obituary.—MR. HENRY EDMUNDS.—With the passing away of Mr. Henry Edmunds, M.Inst.C.E., M.I.E.E., in his 75th year, we have lost another of the pioneers of electric lighting, one who was prominent in the comparatively small circle of gentlemen who in the quite early days of the electrical profession and industry—we refer to the seventies and eighties of last century—began to lay the foundation of things electrical with a faith that the future has so amply justified. Mr. Edmunds was born at Halifax in 1853, and his interest in electric lighting took practical shape at an early age, for he introduced the Jablochkoff and Werdermann electric candles into the United States when he was 24 years old. He straightway returned in 1877 to introduce the Farmer-Wallace dynamo system into England, and in the following year he lighted Liverpool Street railway station. He was associated also in 1878 with the late Mr. Augustus Stroh in the introduction and construction here of the phonograph, while at about



The late Mr. Henry Edmunds, M.Inst.C.E., M.I.E.E.

the same time he invented the phonoscope, and the aquaphone for signalling under water. He was the first engineer to the Brush Electric Light Co., introducing the Brush system here in 1879, and he was in co-operation with Sir Joseph Wilson Swan in the application of his incandescent lighting system on steamships. He had charge of the Swan exhibit at the Paris Exhibition of 1881, and subsequently lit the Opera House at Paris electrically. Many other pioneering electrical and other enterprises called for his ingenuity and attention, and the list of his achievements preceding his entering into partnership in the cable-making business would make a lengthy story. By the great majority of electrical engineers to-day probably very little is known of the large part that he played in such affairs; he is chiefly known by reason of his connection with the cable industry. He became a partner in the firm of W. T. Glover & Co., cable-makers, of Manchester, in 1885, and when that business was formed into a limited company he was its first chairman. The active interest that he took in the cable-making industry is well remembered by

those who were then in a position to note developments which led to the establishment of the Cable Makers' Association, in the founding of which he played so prominent a part. That he always took great pride in this organisation and in the success which it brought to British cable manufacturing, was once more brought out clearly a few months ago in a letter which he wrote to *The Times*, instancing that Association as an early example of the class of co-operative working which is now becoming so generally recognised as necessary for successful industry. Many other interests besides electricity attracted the attention of Mr. Henry Edmunds, for cycling and motoring both claim him as a pioneer—it is stated that he introduced Rolls to Royce and led to the formation of the Rolls-Royce Company, and his interest in the cement business was well known, but though latterly he had not been very much in evidence in electrical affairs, or at electrical functions, there are with us a number who like to recall the days when his cheery manner brought brightness and interest into so many electrical matters, and who will feel that through his passing one more link in the chain of friendships has been severed. Mr. Edmunds was twice married; first to a daughter of Thomas Wayman, M.P. His widow, Mrs. Ellen Murray Edmunds, was a daughter of Mr. A. C. Howard, of Providence, R.I., U.S.A. His son, Mr. Howard Maurice Edmunds, B.Sc., Assoc.M.Inst.C.E., is an electrical engineer and has been connected with oil recovery, railway electrification, combustion and other matters. Mr. Henry Edmunds died after a short illness, at his residence at Hove, last Friday morning. The funeral and interment took place at Stanmer Park, on Tuesday afternoon. We desire to extend to Mrs. Edmunds and the members of the family our sincere sympathy with them in their bereavement. The accompanying photograph is from a carving by the Cameograph Co., Ltd., of 45, Pall Mall, S.W.1.

MR. H. G. CAKEBREAD.—The death occurred, at his residence at Alexandra Park, N.22, on November 20th, of Mr. Herbert George Cakebread, A.M.I.E.E.

MR. C. R. HOSMER.—Canadian Press reports announce the death, at the age of 76 years, of Mr. Charles Rudolph Hosmer, who, before his association with the Bank of Montreal and other business concerns, was actively connected with Canadian telegraph companies. After being president and manager of the Canadian Mutual Telegraph Co., he became, in 1886, head of the Telegraph Department of the Canadian Pacific Railway.

Mr. G. HERSCHELL.—Mr. George Herschell, a former Chief Superintendent of Telegraphs at the General Post Office, Edinburgh, has died following a collapse in the street. Rising through the various grades he became chief superintendent in 1916 and retired in 1921 on reaching the age limit.

Wills.—The late Lord GEORGE HAMILTON, a director of London Underground railway companies, left unsettled property of the gross value of £53,568, with net personalty £52,676.

Mr. T. H. YABBICOM, late city engineer of Bristol, left £13,407 gross and £13,543 net personalty.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Thorpe & Bosco, Ltd.—Private company. Registered November 14th. Capital, £100 in £1 shares. Objects:—To carry on the business of electrical engineers, engineers' agents, auctioneers, valuers, and furnishers, &c. The directors are:—A. W. Thorpe (chairman), "Swangrove," Chalfont St. Peter, Bucks. (director of Waxed Papers, Ltd.); D. W. Thorpe, "Yew Cottage," Abbots Langley, Bucks.; C. G. Bosco, 2, Holmwood Mansions, Acton Hill, W.3. No share qualification required. Registered office: 3 and 4, Clement's Inn, Strand, W.C.2.

Artificial Sunlight, Ltd.—Private company. Registered November 11th. Capital, £600 in 570 ordinary shares of £1 each and 600 management shares of 1s. each. Objects:—To carry on the business of administering electro-therapeutic, balneo-therapeutic, and massage treatment and any other treatment of a like nature by means of medical appliances, X-ray and electro-medical apparatus and other instruments, &c. The directors are:—A. P. Squire, "Belsaye," Great Quarry, Guildford, engineer; C. W. Wildy, Wyss Wood, Kenley, C.A. Registered office: 9, Dapdune Crescent, Woodbridge Road, Guildford.

Harris, Williams (Manufacturers), Ltd.—Private company. Registered November 16th. Capital, £1,000 in £1 shares. Objects: To carry on the business of electricians, gas appliance manufacturers, &c. The permanent directors are:—T. Harris, 30, Caversham Avenue, Palmers Green, N., factor in leather goods and lighting accessories; H. S. Sutherland, "Chislehurst," Carmel Road, Darlington, tar macadam manufacturer; T. Hall, "Wingrove," Corbridge, Northumberland, solicitor. Secretary: T. Hall. Registered office: Servis House, 87, Aldersgate Street, E.C.1.

R. J. Atkinson & Co., Ltd.—Private company. Registered November 16th. Capital, £500 in £1 shares. Objects: To carry on the business of electrical, lighting, heating, wireless, mechanical and general engineers and engineering contractors, &c. The permanent directors are:—R. J. Atkinson, 34, Leeds Road, Harrogate; F. Dickinson, Sefton House, King Edward's Drive, Harrogate. Qualification, £50 shares. Secretary: F. Dickinson. Solicitors: Raworth, Lomas Walker, Butterworth & Wilkinson, Westminster Chambers, Harrogate.

Super Suctor Sales, Ltd.—Private company. Registered November 12th. Capital, £5,000 in 20,000 ordinary shares of 1s. each and 4,000 10 per cent. participating preference shares of £1 each. Objects:—To carry on the business of electrical engineers, manufacturers and general factors of electrical goods, vacuum cleaners, refrigerators, &c. The subscribers (each with one preference share) are:—W. E. Read, Grand Drive, S.W.20, sales manager; W. B. Delany, 8, Lloyd's Avenue, E.C.3, merchant. The first directors are W. H. Chadwick (permanent) and P. S. Coath. Qualification, 100 shares. Remuneration, £100 each per annum (chairman £150). Solicitors: Barclay, Morgan, Griffiths & Co., 124-7, Minories, E.C.3.

Cramic Engineering Co., Ltd.—Private company. Registered November 16th. Capital, £3,000 in £1 shares. Objects: To acquire the business of mechanical and electrical engineers carried on by M. Crabbe and A. H. Mitchell at 170, Marlborough Road, Upper Holloway. The directors are:—M. Crabbe, 10, Carlton Road, Stroud Green, N.4, engineer; A. H. Mitchell, 34, Wray Crescent, Tollington Park, N.4, engineer; F. W. Crabbe, 70, Redstone Road, Hornsey, N.8, engineer (all permanent, subject to holding 400 shares each with not more than £300 each per annum as remuneration). Secretary (*pro tem.*): E. McBean. Registered office: Western Road Works, Southall.

Uneeda Magneto Co. (Leeds), Ltd.—Private company. Registered November 15th. Capital, £500 in £1 shares. Objects: To carry on the business of importers, exporters and repairers of and dealers in motor cars, magnetos, dynamos and batteries of all kinds, &c. The directors are:—C. B. King, 14, Swinnow Drive, Bramley, motor engineer; J. W. Dufton, 45, Warrel's Grove, Bramley, builder. Solicitors: Lupton and Fawcett, 26-7, Bond Street, Leeds.

Gothic Electrical Supplies, Ltd.—Private company. Registered November 17th. Capital, £3,000 in £1 shares. Objects: To acquire the business of electrical and general merchants carried on at 3, Gothic Arcade, Snow Hill, Birmingham, as Gothic Electrical Supplies, to adopt an agreement with H. N. Hughes and S. B. Beardmore, and to carry on the said business and that of electrical, wireless, telephone, telegraph, mechanical, gas, motor and general engineers and merchants, electricians, &c. The first directors (to number not fewer than two or more than five) are:—H. N. Hughes, 224, Albert Road, Handsworth, Birmingham, electrical engineer (chairman); S. B. Beardmore, 66, Burnaston Road, Hall Green, Birmingham, electrical engineer (both permanent). If H. N. Hughes dies while holding 1,000 shares he may by will or codicil appoint one person to be a director in his place, and in default of such appointment his legal representative shall be entitled to exercise such power. Qualification: £250. Secretary: S. B. Beardmore. Solicitors: Westwood, Morris & Co., 36, Bennetts Hill, Birmingham.

A. Rist (1927), Ltd.—Public company. Registered November 15th, with a nominal capital of £60,000 in 80,000 8 per cent. cumulative preferred ordinary shares of 10s. each and 400,000 deferred shares of 1s. each. The objects are to acquire the business of manufacturers

of motor and electrical accessories heretofore carried on by A. Rist, Ltd. The directors are:—D. A. V. Rist, Avonholme, Park Estate, Oulton Broad, near Lowestoft; W. A. Hunter, 115, Cromwell Road, S.W.7 (director of Brazilian, Canadian and General Trust, Ltd.); C. C. R. Tilley, "Eveleigh," The Avenue, Lowestoft; F. J. Benson, 102, Park Street, W.1. Qualification: £250 shares. Remuneration: £100 each per annum (chairman £150). Registered office: 113, Moorgate, E.C.2.

Lincolnshire Power Co., Ltd.—Registered as a public company on November 18th, with a nominal capital of £10,000 in £1 shares. The objects are to carry on the business of electrical engineers, electricians, engineers and contractors, manufacturers of electrical apparatus and mechanical and chemical engineers, &c. The minimum cash subscription is 10,000 shares. The first directors are:—W. B. Cownie, 19b, Pembridge Square, W.2; G. H. Nisbett, Huyton Hey House, Huyton, Liverpool. Registered office: 62 and 63, Queen Street, E.C.4.

Official Returns of Electrical Companies.

F. Patrick, Ltd.—J. W. Hirst, C.A., of 29, East Parade, Leeds, ceased to act as receiver or manager on November 12th, 1927.

Stenner & Gunn, Ltd.—Particulars filed of £7,000 debentures authorised October 19th, 1927, charged on the company's undertaking and property, present and future, including uncalled capital (if any), the amount of the present issue being £4,000.

Welwyn Garden City Electricity Supply Co., Ltd.—Capital, £25,000 in 23,500 8 per cent. cum. preference shares of £1 each and 30,000 ordinary shares of 1s. each. Return dated December 31st, 1926 (filed July 2nd, 1927). 503 preference and 29,000 ordinary shares taken up. £1,953 paid. Mortgages and charges, £20,000.

Silgolum, Ltd.—Issue on September 29th, 1927, of £150 debentures, part of a series already registered.

Embleton & Barker, Ltd.—Capital, £1,000 in £1 shares. Return dated June 2nd, 1927. All shares taken up. £500 paid. £500 considered as paid. Mortgages and charges, nil.

Rowland, Edwards & Co., Ltd.—Capital, £2,050 in 2,000 preference shares of £1 each and 1,000 founders' shares of 1s. each. Return dated April 21st, 1927. 1,750 preference and 1,000 founders' shares taken up. £650 paid on 650 preference shares. £1,150 considered as paid on 1,100 preference and 1,000 ordinary shares. Mortgages and charges, £600.

Cooke & Stevenson, Ltd.—Capital, £1,000 in £1 shares. Return dated May 10th, 1927. All shares taken up. £1,000 considered as paid. Mortgages and charges, nil.

Charles Warren, Ltd.—Capital, £6,000 in £1 shares. Return dated June 14th, 1927. 5,700 shares taken up. £1,500 paid. £4,200 considered as paid. Mortgages and charges, nil.

Teignmouth Electric Lighting Co., Ltd.—Capital, £20,000 in 7,500 7 per cent. cum. preference and 12,500 ordinary shares of £1 each. Return dated July 5th, 1927. All shares taken up. £19,500 paid. £500 considered as paid. Mortgages and charges, £12,500.

British B.A.G., Ltd.—Capital, £12,000 in £1 shares. Return dated June 27th, 1927. All shares taken up. £9,000 paid. £3,000 considered as paid. Mortgages and charges, nil.

Phœnix Dynamo Manufacturing Co., Ltd.—Capital, £100 in £1 shares. Return dated August 8th, 1927. 2 shares taken up. £2 paid. Mortgages and charges, nil.

Chepstow Electric Lighting and Power Co., Ltd.—Capital, £10,000 in £1 shares. Return dated June 1st, 1927. 5,510 shares taken up. £1,537 paid. £3,905 considered as paid. Mortgages and charges, £3,000.

Atkins & Wallis, Ltd.—W. H. Clegg, of 117, Corbyn Street, Finsbury Park, N.4, ceased to act as receiver on July 20th, 1927. (Notice filed November 12th.)

Wallingford and District Electric Supply Co., Ltd.—Capital, £13,000 in £1 shares. Return dated May 25th, 1927. All shares taken up. £13,000 paid. Mortgages and charges: £3,500.

Satisfaction in full on November 1st, 1927, of first mortgage debenture dated January 23rd, 1926, securing £3,500 and further advances not exceeding therewith £4,000.

Debenture charged on property at Benson, Oxford and the company's undertaking and property, present and future, including uncalled capital, dated November 2nd, 1927, to secure all moneys due or to become due from the company to Lloyds Bank, Ltd.

Scott Brothers (Halifax), Ltd. — Debenture charged on the company's undertaking and property, present and future, including uncalled capital, and property at Beechhill, Pellow Lane, Halifax, and all fixtures, &c., dated October 31st, 1927, to secure all moneys due or to become due from the company to Lloyds Bank, Ltd.

Satisfaction in full on October 31st, 1927, of charge dated April 14th, 1924, securing all moneys not exceeding £6,000.

Richardsons, Westgarth & Co., Ltd.—Capital, £700,000 in 350,000 preference and 350,000 ordinary shares of £1 each. Return dated August 23rd, 1927. All shares taken up. £700,000 paid. Mortgages and charges, £25,605.

J. Poore & Sons, Ltd.—Particulars filed of £482 debentures authorised November 2nd, 1927, charged on the company's property, present and future, including uncalled capital, the whole amount being now issued.

Mersey Cable Works, Ltd.—Satisfaction to the extent of £4,400 on October 29th, 1927, of mortgage dated October 12th, 1926, securing £5,500.

Union Cable Co., Ltd.—Capital, £100,000 in £1 shares. Return dated June 9th, 1927. All shares taken up. £75,000 paid, being £1 per share on 50,000 and 10s. per share on 50,000 shares. Mortgages and charges, nil.

County Wireless Services, Ltd.—Capital, £500 in 400 preference and 100 ordinary shares of £1 each. Return dated December 31st, 1926 (filed May 5th, 1927). All shares taken up. £470 paid on 400 preference and 70 ordinary shares, £30 considered as paid on 30 ordinary shares. Mortgages and charges, nil.

H. A. Stonham & Co., Ltd.—Capital, £1,200 in £1 shares. Return dated September 17th, 1927. All shares taken up. £1,200 paid. Mortgages and charges, nil.

Sheringham and District Electricity Supply Co., Ltd.—Capital, £2,000 in £1 shares. Return dated May 23rd, 1927. 400 shares taken up. £400 paid. Mortgages and charges, nil.

New Armature Co., Ltd.—Capital, £1,000 in £1 shares. Return dated December 31st, 1926 (filed May 18th, 1927). 745 shares taken up. £745 paid. Mortgages and charges, nil.

Malmesbury Electric Supply Co., Ltd.—Capital, £6,000 in 3,000 preference and 3,000 ordinary shares of £1 each. Return dated June 14th, 1927. 1,920 preference and 2,800 ordinary shares taken up. £4,720 paid. Mortgages and charges, nil.

Bell Electrical Co. (Northern), Ltd.—Capital, £1,000 in £1 shares. Return dated May 11th, 1926 (filed August 17th, 1927). 753 shares taken up. £750 paid. £3 considered as paid. Mortgages and charges, nil.

E. Goldston, Ltd.—Capital, £2,500 in 2,250 preferred ordinary shares of £1 each and 5,000 founders' shares of 1s. each. Return dated July 9th, 1926 (filed May 30th, 1927). 1,282 preferred ordinary and 5,000 founders' shares taken up. £200 paid on 200 preferred ordinary shares. £1,332 considered as paid on 1,082 preferred ordinary and 5,000 founders' shares. Mortgages and charges, nil.

City Notes.

Prospectuses.

Atlas Light and Power Co., Ltd.—Last week this company (formerly the Argentine Light and Power Co., Ltd.) offered for subscription £530,000 of 6 per cent. redeemable debenture stock at £99 per cent., and 530,000 7 per cent. cumulative preference shares of £1 each at 20s. 6d. The authorised share and debenture capital of the company is £8,430,000 and, with the present issue, the total issued capital is £7,972,024. The debenture stock is redeemable at £105 per cent. by drawings or at any time on three months' notice. The preference shares, in the event of winding up, will be entitled to the return of the amount paid up, plus a premium of 20 per cent. The Atlas Co. owns the entire share and loan capital of the following companies operating in South America:—the Cordoba Light and Power Co., the Cordoba (Argentine) Electric Tramways Construction Co., Ltd., the Argentine Tramways and Power Co., Ltd. (operating in Santa Fé), La Sociedad Comercial de Montevideo, La Transatlantica Cia. de Tranvias Electricos de Montevideo (with the exception of certain debentures), the Compania de Luz y Fuerza de Parana, and the Parana Tramways Co., Ltd. The company also holds a controlling interest in the Tucuman Tramways, Light and Power Co., Ltd., which, in turn, controls two other electrical companies. The proceeds of the issue are required, *inter alia*, for the discharge of certain obligations for the construction of the new Santa Fé power station, and for the extension of other stations and systems. The issue was fully subscribed.

A. Rist (1927), *Ltd.*—This company, motor and electrical accessories manufacturers, has an authorised capital of £60,000. It has been formed to take over an existing business, at Lowestoft, of makers of ignition coils, electric horns, lamps and other equipment. Last week the company made an issue of 70,000 8 per cent. cumulative participating preferred ordinary shares of 10s. each and 400,000 deferred shares of 1s. each at par.

Stock Exchange Notices.

Dealings in the following have been specially allowed by the Committee under Rule 159:—

Aldershot and District Traction Co., Ltd.—50,000 new ordinary shares of £ 1 each, issued at £ 1 2s. 6d. per share, 12s. 6d. paid, Nos. 100,001 to 150,000.

Atlas Light and Power.—£530,000 six per cent. redeemable debenture stock, issued at £99 per cent., partly paid and fully paid; 530,000 seven per cent. cumulative preference shares of £1 each, issued at £1 0s. 6d. per share, partly paid and fully paid, Nos. 2,000,001 to 2,530,000.

United River Plate Telephone.—152,000 new ordinary shares of £5 each, fully paid, Nos. 1,064,001 to 1,216,000.

The undermentioned have been ordered to be officially quoted:—

Cornwall Power.—150,000 seven per cent. convertible preference shares of £1 each, fully paid, Nos. 250,001 to 400,000.

Lucas (Joseph).—60,300 ordinary shares of £1 each, fully paid, Nos. 759,001 to 819,300.

The Armstrong-Vickers Fusion.

The boards of Sir W. G. Armstrong, Whitworth & Co., Ltd., and Vickers, Ltd., have issued circulars to their share and debenture holders outlining the scheme for the merging of their heavy steel and armaments branches. A new company is to be formed, with a capital limited in the first instance to £21,000,000, to be known as Vickers-Armstrongs, Ltd. The chairman will be General the Hon. Sir Herbert Lawrence, G.C.B. A scheme for insuring the profits has been arranged. The purchase price of the undertakings is fixed at £13,000,000, which will be satisfied by the issue of shares to the following amounts:—Vickers, £8,500,000; Armstrongs, £4,500,000. Meetings will be held on November 28th to consider the proposals.

Burma Electric Supply Co., Ltd.

The total revenue for the year ended July 31st last was £56,284 and the profit £22,470, to which were added profit from exchange £3,062, interest on investments £1,927, and £6,581 brought forward, making £34,040. It is proposed to transfer £10,000 to reserve and to pay a final dividend of 4 per cent., making 8 per cent. for the year. Last year's dividend was the same, but, in addition, a capital bonus of 20 per cent. was distributed. At the meeting on November 30th a resolution will be submitted providing for the alteration of the Articles of Association in connection with the quotation of the company's shares on the Stock Exchange.

Western Telegraph Co., Ltd.

The directors' report for the year ended June 30th last records a revenue of £1,332,677 and working expenses of £828,504. After providing for debenture interest and income tax, there is a balance of £412,075 (as compared with £590,626 in 1925-26). To this is added £329,172 brought forward, making £741,247. Four quarterly dividends, making a total of 10 per cent., free of tax, have been paid (as in the previous year), and £429,352 is carried forward. The meeting was to be held yesterday (Thursday).

Montevideo Telephone Co., Ltd.

The net profit for the year ended July 31st last amounted to £39,489, as compared with £37,886 in 1925-26. The interim dividend (3 per cent., tax free) absorbed £6,514, and £15,099 brought forward is added, leaving £48,074. It is proposed to pay a final dividend of 5 per cent., free of tax, making 8 per cent. for the year (as in 1925-26); to transfer £22,000 to reserve; and to carry forward £15,217. The report states that the business continues to progress satisfactorily and the number of connections at the end of the year was 14,583. Meeting: November 28th.

A. J. Stevens & Co. (1914), Ltd.

The net profit for the year ended August 31st last was £17,287, as compared with £44,891 in 1925-26. It is proposed to pay a dividend of 7½ per cent., as against 12½ per cent. last year, and £15,728 is carried forward, as compared with £28,136 brought in.

Adelaide Electric Supply Co., Ltd.

A final dividend of 6 per cent. has been declared on the ordinary shares, making 12 per cent. for the year, as in 1925-26. The dividend is free of British tax in the case of shares entered upon the London register.

Sir William Arrol & Co., Ltd.

At a meeting held last week the shareholders passed a resolution for the reduction of the ordinary capital from £296,700 to £118,680 and the preference shareholders agreed to the cancellation of arrears of dividend.

Melbourne Electric Supply Co., Ltd.

The directors propose to pay a final dividend of 5 per cent. on the consolidated ordinary stock, making 10 per cent. for the year, free of British tax, in the case of stock on the London register. Last year's dividend was the same.

Northern Mexico Power and Development Co.

Dividends of 1¾ per cent. on the preference stock and 1 per cent. on the common stock have been declared.

Pennsylvania Water and Power Co.

A dividend of 62½ cents per share has been declared on the no-par-value common shares for the quarter ending December 31st.

Electric Construction Co., Ltd.

An interim dividend at the rate of 6 per cent. per annum has been declared on the ordinary shares.

Chloride Electrical Storage Co., Ltd.

An interim dividend of 5 per cent. has been declared, as last year.

Swiss Company.

The *Electro Values Company*, Basle, reports an increase in the net profits from 1,870,000 fr. in 1925-26 to 2,030,000 fr. in 1926-27. The dividend is at the rate of 7 per cent. on the old share capital of 20,000,000 fr. and 1¾ per cent. on the new

Stocks and Shares.

MONDAY EVENING.

THE chief price alteration in our lists this week is a rise of 14 points in Brazilian Traction ordinary, the shares advancing to 216. The preference followed suit with a gain of 12, to 180. The remarkable fluctuations in the shares are due to a considerable volume of dealing in Montreal and in Brussels, London being content to play a somewhat passive part in the matter. Although the shares are in dollar denomination, and a rise or fall of 5 points is equal to no more than £1 sterling, they command a large following in Belgium, with Dutch interests also lending an occasional hand. In this country the violence of the changes renders the shares popular with those speculators who abhor what they term a sticky market. It must be admitted that Brazilian Tractions give their supporters plenty of excitement; not to mention a thrill every now and then.

Home Electrics.

Although a steady business continues to be done in the electrical section, there is very little of interest to report, and price changes are few. So far as the London group of companies is concerned, it is only necessary to state that the usual "bread and butter" business is afoot, and that, beyond a rise of 6d. in Chelseas, there are no price alterations to record. Turning to the "Parliamentary" or "bulk supplies" companies, Newcastle new are a shade harder at 23s., with the old shares unchanged at 23s. 9d. Shropshires changed hands two or three times, the "A" at 28s., and the "B" at 27s. 6d. North Metropolitan ordinary shares were marked "ex" at 27s. 6d., on which basis business was done on most days. Yorkshires at 32s. show no change.

A considerable number of North Wales ordinary are being dealt in, but the price remains at 15s. to 15s. 6d. A firm of dealers have issued an interesting map of the company's area, and illustrate very clearly this concern's potentialities.

Of distribution companies, Edmundson's and Urbans, which we mentioned last week as being fully valued, are both dull spots, business in the latter being done at 34s. 6d. Transactions took place as high as 40s. in the previous week. An active share has been Electric Supply 6 per cent. new preference. A large number were sold during the week at 21s. 6d. and 21s. 9d., free of stamp. Investors appear to be turning their attention to some of the companies in this group, which suffered rather unduly from the industrial trouble of last year. During the last week Fife and Llanelly, for instance, have both been inquired for round about 16s. Fife, which paid a dividend of 8 per cent. for some years, dropped its distribution to 6 per cent. in 1925, and to 3 per cent. last year. Llanelly, which paid 7 per cent. for some years on its ordinary shares, lowered the dividend to 5 per cent. in 1925, and passed it entirely in 1926. Should these, and similar concerns, be able to rehabilitate themselves during the next year or so, and there appears to be no reason why they should not, the shares carry speculative attraction at the current levels.

The Beaver Trust confines its activities almost exclusively to investments in British and Colonial electric public utilities, which is the reason for mentioning, in a column devoted to electricity supply matters, that dealings are taking place in the £1 share of this trust in the neighbourhood of 21s. Dividends of 7½ per cent. per annum have been paid for the last three years, and the shares at the present price show a yield of £7 2s. 10d. per cent. on the money.

Overseas Electrics.

Atlas Light & Power ordinary are again an animated spot in this section, business being done as high as 17s. 10½d. x.d. The price, allowing for deduction of the recent dividend, has risen 2s. in the last few weeks, and many thousands of

shares have changed hands. We understand that this company's issue of debenture stock and preference shares was fully subscribed. Dealings were expected to start on the Tuesday in this week. The prospectus of this issue set out, in clear manner, the company's position, both as to capital assets and revenue. Its estimates of future earnings were supported by figures easy to understand. The prospectus might serve as a model to other companies proposing to make a similar public issue.

Whitehall Electric Investments 7½ per cent. preference are better at a guinea bid, and the debenture is again 10s. per cent. up at 102½. Activity has continued in Perak River-Hydro Electric shares, without, however, affecting the previous price of 15s. The 7 per cent. debenture stock has strengthened to 104.

Mexican Light & Power preferred is 4 up, at 76. Monterey Railway, Light & Power "A" debenture at 47½, and the "B" debenture at 7½, are both better, business being done at 48 and 7 respectively. Vera Cruz Electric 5 per cent. bonds gained 8 points, rising to 62½, apparently on sinking-fund purchases.

Cable Stocks Weak.

The Western Telegraph Company has provided the cable market with an unpleasant shock in the shape of a decrease of £178,000 in the year's disposable balance. Revenue, at £828 500 is £208,000 down. Nothing is placed to reserve, which fund received a quarter of a million pounds last year. The meeting is to be held on the Thursday in this week. The chairman's speech is anxiously awaited by shareholders, who want to know whether the diminution in receipts is due to radio competition, or whether it is the result of a cut in rates. Provided the traffics keep up, people will not mind so much as they are likely to do if the falling-off is the result of a pronounced shrinkage in business handled by the company.

Following publication of the figures, Western Telegraphs dropped 15s., to 16½; Eastern Extensions 5s., to 16⅞; and Eastern ordinary 2 points to 168½. Paradoxically enough, Globe ordinary are 2s. 6d. better, at 17⅞.

Telephone and Wireless.

United River Plates are nominally 15s. lower, but this is accounted for by deduction of the rights, valued at 13s., from the price. The new shares are moderately active, around 4⅛. It may be recalled that the old shares went ex 3s. per share net dividend, at the end of October. Montevideo Telephones remain at 40s., the final dividend of 5 per cent. making 8 per cent. for the year, the same as the rate paid for the previous year. The accounts come out well, and the company is making satisfactory progress. Wireless shares continue to show a good deal of liveliness. Marconis jumped about erratically and, as compared with a week ago, have fallen 1/16 to 26s. 3d. Marconi Marines regained part of their loss, being up to 30s. Canadian Marconis strengthened for a few minutes to 7s., but shares promptly came in to meet the demand, and the price sagged to 6s. 9d.

Shares at a Farthing.

British Columbia Electric Railway stocks have gone ahead. The deferred advanced to 193, being 4 up, and the preferred at 152 is 2 points higher. Lisbon Trams are better at 14s. 6d. The London Traction issues are colourless. Lancashire United Trams hardened to 7s. 9d. The company's traffics for the current year show an increase of £41,000, of which about 85 per cent. has come from motor-buses.

As a Stock Exchange curiosity of dealing, it may be mentioned that South Staffordshire Tramways (Lessee) deferred shares were dealt in a few days ago at one farthing per share.

Underground Railway stocks and shares are dull. Metropolitan ordinary shed a point, and Underground Electric £1 shares eased off to 19s., interest having subsided for the time being.

Armstrong-Vickers.

Great discussions are taking place around the scheme propounded by Armstrongs & Vickers for joint operation of three important sections of the companies' work. A new undertaking is to be formed, and the proposed manner of division of shares between the constituent parts of the two concerns, Vickers and Armstrongs, has aroused criticism that may become vocal. In the market the prices of Armstrongs have gone back to some extent after the early rises they achieved on announcement of the arrangement. Vickers, on the other hand, have started to improve a little. Iron and steel shares are irregular in tendency. Babcocks hold their last week's gain at 62s. 6d.

India Rubber Rally.

India Rubber shares have partially recovered from the sharp fall that occurred on the issue of the report, showing a loss of £45,400 for last year. Buyers from the provinces have been willing to pay up to 15s. British Aluminiums, Callenders and Henleys are firmer on the week. A drop of 5s., to 83s. 9d., in Ever-Ready shares took place without any explanation transpiring. The rubber share market is a trifle better.

Share List of Electrical Companies.

HOME ELECTRICITY COMPANIES.

	Nom. £	Dividend. 1925.	Dividend. 1926.	Price Nov. 21 1927.	Rise or fall.	Yield. p.c.
Bournemouth and Poole	1	14	14	58/9	—	4 15 3
Brompton Ordinary	1	10	8⅝	24/6	—	5 14 3
Charing Cross Ordinary	1	15	8½	26/-	—	5 7 8
do. do. 4½ Pref. ...	1	4½	4½	17/6	—	5 2 10
Chelsea	1	12	8⅝	25/6	+6d.	5 9 10
City of London	1	15	7½	28/9	—	4 17 5
do. do. 6% Pref.	1	6	6	22/6	—	5 6 8
Clyde Valley	1	8	8	32/6	—	4 18 6
County of London	1	15	7½	28/-	—	5 0 0
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Edmundson's Ordinary	1	8	10	42/6	—	4 14 4
do. 7% Pref.	1	6	7	24/6	—	5 14 3
Elec. Supply Corporation	1	10	10	32/6	—	6 3 0
Kensington Ordinary	1	15	8	25/6	—	5 9 10
Lancs. Light and Power	1	7½	7½	27/-	—	5 11 1
London Electric	1	10	8½	24/6	—	5 14 3
do. do. 6% Pref.	5	6	6	5⅞	—	5 11 3
Metropolitan	1	11	8	30/-	—	4 18 4
do. 4½% Pref.	1	4½	4½	17/-	—	5 8 8
Midland Counties	1	5½	6	24/-	—	5 0 10
Newcastle-on-Tyne Ordinary ...	1	7	8	23/9	—	4 4 3
do. 5% Pref. ...	1	5	5	17/6	—	5 14 3
do. 7% Pref. ...	1	7	7	25/-	—	5 12 0
Notting Hill 6% Pref.	10	6	6	10⅝	—	5 11 7
North Met. Elec. 6% Pref.	1	6	6	22/-	—	5 9 1
St. James' and Pall Mall	5	17½	8	26/-	—	5 7 8
South London	1	15	8½	25/-	—	5 12 0
South Metropolitan Pref.	1	7	7	1⅛	—	6 8 0
Urban Ordinary	1	7	7	1⅜	—1/16	3 16 6
do. 6% Pref.	1	6	6	1 1/16	—	5 12 0
Westminster Ordinary	1	15	8½	25/-	—	5 12 0
Whitehall Elec. Invst. 7½% Pref. ...	1	7½	7½	21/-	—	7 2 10
Yorkshire Elec.	1	8	8	32/-	—	5 0 0

HOME RAILS.

Central London Ord. Assented ...	Stock	4	4	71	—	5 12 8
Metropolitan	,,	5	5	59	—1	5 1 8
do. District	,,	5½	5½	63½	—	5 10 3
Underground Electric	£1	Nil	1½	19/-	—3d.	1 11 7
do. do. Income ...	Bonds	6	6	105	—	5 14 3

TELEGRAPHS AND TELEPHONES.

Anglo-Am. Tel. Pref.	Stock	6	6	108½	—	5 15 11
do. Def.	,,	1½	1½	24⅜	—	6 1 3
Automatic Telephone	1	8	10	48/-	—	4 3 4
Chili Telephone	5	5	5	7⅜	—	3 18 3
Eastern Extension	10	10	10	16⅞	—¼	*5 18 6
Eastern Tel. Ord.	Stock	10	10	168½	—2	*5 18 8
Globe Tel. and T. Ord.	10	10	10	17⅜	+⅛	*5 12 8
do. do. Pref.	10	6	6	10⅛	—	5 10 4
Great Northern Tel.	10	20	20	57½	+½	5 5 11
Indo-European	25	8½	10	43½	—	*5 14 11
Marconi	1	Nil	Nil	26/3	—1/8	... ...
Marconi-Marine	1	7½	8½	30/-	+1/8	5 16 8
Oriental Telephone Ord.	1	12	12	51/3	—	*4 13 6
United R. Plate Tel.	5	8	8	9⅞	—⅛	*4 1 5
Western Telegraph	10	10	10	16½	—⅛	*6 0 9

HOME AND FOREIGN TRAMS, &c.

Anglo-Arg. Trams First Pref. ...	5	5½	5½	8½	—	7 17 2
do. do. 2nd Pref. ...	5	6	6	8 3/16	—	8 8 6
do. do. 5% Deb. ...	Stock	5	5	74⅛	—	6 14 3
British Electric Traction Def. Ord.	,,	8	8	500	—	... ...
do. do. 8% Pref. Ord.	,,	6	8	124½	—	6 8 6
Brazil Traction	100	5	5	216	+14	2 14 2
Brit. Columbia Elec. Rly. Pcc. ...	Stock	5	5	99½	—	5 6 11
do. do. Preferred ...		6⅝	6⅝	152	+2	4 2 3
do. do. Deferred ...	,,		8	193	+3	*4 3 4
do. do. Deb. ...	,,	4½	4½	80½	—	5 5 11
London & Sub. Trac. 5% Pref. ...	1	Nil	Nil	9/6	—	Nil
London United Tram. Deb. ...	Stock	4	4	63½	—	6 16 9
Mexico Trams, 6% Bonds	—	5	5	76	—	6 11 7
Mexican Light Common	100	Nil	Nil	58	—	Nil
do. Pref.	100	Nil	Nil	76	+4	Nil
do. 1st Bonds	—	5	5	79½	—	6 5 9
Yorkshire (West Riding)	1	5	—	7/6	—	... ...

MANUFACTURING COMPANIES.

Babcock & Wilcox		18	18	8½	—	4 8 2
British Aluminium Ord.	1	12½	10	45/6	+6d.	4 8 0
British Elec. Transformer Pref. ...	1	Nil	7	18/3	—	7 18 6
British Insulated Ord.	1	15	15	8½	—	3 16 4
Brush Ord.	1	10	10	28/9	—	6 16 4
Callenders	1	15	15	9½	+⅛	3 16 2
do. 6½% Pref.	1	6½	6½	23/9	—	5 9 8
Crompton Parkinson Pref. Ord. ...	1	Nil	Nil	16/-	—	... ...
Edison-Swan	£/-	10	10	10/-	—	4 0 0
do. 5% Deb.	Stock	5	5	90	—	5 11 1
Electric Construction	1	10	7½	28/9	—	5 4 4
Enfield Cable Pref.	1	7½	7½	25/-	—	6 0 0
English Electric	1	Nil	Nil	10/-	—	... ...
do. do. Pref.	1	8	—	13/-	—	... ...
Gen. Elec. Pref.	1	6½	6½	24/6	—	5 6 1
do. Ord.	1	7½	7½	34/6	—	4 6 1
Henley	1	20	25	104/6	+9d.	4 15 9
do. 4½% Pref.	5	4½	4½	4½	—	5 6 0
India-Rubber	1	5	—	15/9	+1/3	... ...
Johnson & Phillips	1	17½	15½	49/3	—	5 1 8
Met.-Vickers Ord.	1	8	8	28/9	—	5 11 4
do. Pref.	2	8	8	2⅞	—	5 4 8
Siemens Ord.	1	7	7½	30/-	—	5 0 0
Telegraph Construction	12	10	10	20⅜	—	*4 1 7

* Dividends paid free of Income Tax.

Our Foreign Electrical Trade.

Electrical Exports and Imports during October, 1927.

THE statistics of our electrical exports and imports for October are not very encouraging, for, as will be seen from our table, there was a large fall in the export total both as compared with September and with October, 1926. The greatest decrease in both comparisons occurred in insulated wires and cables —£44,391 and £131,264 respectively. Unenumerated electrical machinery experienced a substantial fall as against the September figure, but was actually £35,382 more than in October, 1926. Other large declines were registered by batteries and accumulators and unenumerated goods and apparatus. There were two prominent increases, £12,271 in glow lamps and £11,848 in railway and tramway motors, as compared with September last. In comparison with the corresponding month of last year, telegraph and telephone instruments and apparatus showed a large fall. The increase of exports during the first ten months of the year as compared with the corresponding period of 1926 was further reduced—to £602,838.

The import section showed a general increase; in fact, compared with the preceding month, there was only one fall, namely, submarine cable, which decreased by the negligible amount of £73. Important rises occurred in unenumerated electrical machinery, unenumerated goods and apparatus, telegraph and telephone apparatus, and batteries and accumulators. Only two decreases appeared in the comparison with October, 1926, and neither of those was very substantial. The net result was an increase of £128,981, to which unenumerated machinery contributed £48,779. For the first time this year the increase of imports for the completed portion of the year rose above the equivalent figure for exports. The re-export section showed increases in both comparisons, an outstanding feature being meters and instruments.

The following table shows the distribution of our October electrical machinery exports:—

Destination.	Oct., 1926. £	Oct., 1927. £	Inc. or dec. £
Europe	119,369	64,158	− 55,211
Japan	27,050	32,870	+ 5,820
South America ...	30,064	56,629	+ 26,565
South Africa ...	92,325	48,709	− 43,616
British India ...	98,684	119,962	+ 21,278
Australia ...	64,062	94,583	+ 30,521
New Zealand ...	14,081	17,716	+ 3,635
Canada	31,131	39,746	+ 8,615
Other countries	57,491	65,788	+ 8,297
Total ...	£534,257	£540,161	+ £5,904

	Exports. Electrical exports for Oct., 1927.	Inc. or dec. as compared with Sept., 1927.	Inc. or dec. as compared with Oct., 1926.	Imports. Electrical imports for Oct., 1927.	Inc. or dec. as compared with Sept., 1927.	Inc. or dec. as compared with Oct., 1926.	Re-Exports. Electrical re-exports for Oct., 1927.	Inc. or dec. as compared with Sept., 1927.	Inc. or dec. as compared with Oct., 1926.
Electrical goods and apparatus (unenumerated)	£176,119	−£15,861	−£31,426	£125,445	+£18,893	+£16,374	£5,842	+£1,406	−£311
Insulated wires and cables ...	244,804	− 44,391	− 131,264	79,498	+ 8,458	+ 17,024	1,146	+ 544	− 1,847
Glow lamps	44,677	+ 12,271	+ 6,081	47,478	+ 781	+ 15,375	284	− 279	− 158
Arc lamps and parts	5,704	+ 4,330	+ 5,142	3,955	+ 1,675	+ 1,881	22	− 41	− 13
Batteries and accumulators ...	95,820	− 29,187	− 8,960	107.552	+ 13,123	+ 12.761	380	+ 144	+ 26
Meters and instruments ...	26,112	− 1,250	− 5.364	25,212	+ 732	+ 11,905	3,604	+ 2,864	+ 3,124
Carbons	3,058	− 1,413	+ 1,606	7,004	+ 2,197	− 699	24	− 77	− 453
Electrical Machinery—									
Electrical machinery (unenumerated)	299 967	− 42,283	+ 35,382	143,147	+ 14,574	+ 48.779	10,341	− 2 630	+ 5,618
Railway and tramway motors	44 564	+ 11,848	− 6,017	—	—	—	—	—	—
Other motors and generators...	195,630	− 9,644	− 23,461	—	—	—	—	—	—
Switchboards (not telegraph or telephone)	5,267	− 312	− 3,176	89	+ 89	+ 89	—	—	—
Telegraph and Telephone Cable and Material—									
Telegraph and telephone wires and cable (not submarine)	97,246	+ 4,523	− 11,056	11.838	+ 5,096	− 1,693	109	+ 109	+ 109
Submarine telegraph and telephone cable...	14,025	+ 3,613	+ 7,423	—	− 73	− —	—	—	—
Telegraph and telephone instruments and apparatus ...	225,004	+ 1,130	− 41,755	56,479	+ 17,151	+ 7,185	5,247	+ 152	− 148
Totals	£1,477,997	−£106.626	−£206,845	£607,697	+ £82,696	+£128,981	£26,999	+£2,192	+£5,947
Increases and decreases for ten months of 1927 ...		Exports: + £602,838			Imports: + £789,135			Re-exports: − £6.342	

The Situation in China.

An Unpromising Outlook.

MR. H. H. FOX, C.M.G., F.R.G.S., Commercial Counsellor at Peking, and Mr. H. J. Brett, Commercial Secretary at Shanghai, have prepared for the D.O.T. a report upon the commercial, industrial, and economic situation in China to June 30th, 1927 (Stationery Office, 1s. 6d. net). It is pointed out in the introduction that although the present time is not propitious for the opening up of trade with China by those without experience, the future possibilities of the market are too great to be neglected. The authors recommend the use of the service provided by the Department of Overseas Trade by those who require information on trading matters. They also urge the desirability of manufacturers providing the fullest information to prospective agents. Traders are warned against giving credit to unknown Chinese firms, and the opinion is expressed that business should be done only through British or other "foreign" houses. The Chinese registration of trade marks is now generally recognised and British owners wishing to register their marks can obtain a list of suitable agents from the D.O.T.

The second chapter of the report reviews the complicated military and political situation, and it is stated that whatever confidence may be felt that China will ultimately take her place as one of the great trading nations, there is as yet no indication of any escape in the near future from the difficulties by which she is at present beset.

The 1926 statistics of the Shanghai Municipal Electricity Department record a substantial growth in the amount of energy sold for power and traction purposes.

During 1926 the value of machinery for electric power stations imported into China was 831,606 Haikwan taels (Hk.-tael averaged 3s. 1½d. during 1926). This compared with 858,151 taels in 1925 and 807,581 taels in 1924. The value of imports of electrical materials and accessories increased from 6,890,076 taels in 1925 to 8,941,185 taels in 1926. The greater part of the increased trade went to Japan, whose share rose from 2,366,913 to 3,406,608 taels. Great Britain's share increased from

1,198,922 to 1,665,568 taels, and that of the United States from 851,387 to 1,422,291 taels. The value of German imports declined slightly in comparison with 1925, but they show a considerable fall when compared with 1924 when Germany was the principal supplier.

The oil engine, particularly the crude-oil type, continues to gain in favour to the practical exclusion of the gas engine. In the heavy slow-speed engines Great Britain is holding her own, but the high-speed light type comes mainly from the United States, Sweden and Germany.

The restrictions imposed by the Government on the importation of radio apparatus have not been removed, but in spite of this commercial development continues to make slow but steady progress. Statistics of radio imports are not available as the apparatus is usually taken in under another name, but it is believed that about 10,000 sets have been imported during the past three years. There are at present five broadcasting stations in Shanghai (two American, two Japanese, and one British), one in Tientsin and two in Manchuria. Broadcasting is not yet a profitable commercial undertaking, and the Shanghai stations are maintained by firms interested in the sale of apparatus, which is mainly of American origin. The information feature of broadcasting is capable of great development in China, but no real progress can be made until the trade is legalised and placed on a proper basis.

The report ends with a chapter on British trade with China and is couched in very pessimistic terms stating that "it is hardly possible to regard the immediate future of British commercial interests in this country otherwise than with grave anxiety."

Mr. Oswald White, British Consul at Dairen, contributes an annex dealing with South Manchuria. He quotes Customs figures which show the overwhelming dominance of Japan in the machinery trade. In electrical machinery the imports for 1926 were as follows:—From Japan £22,060, Great Britain £1,150, United States £3,530, Germany £3,880. Mr. White says that there has been a good demand for machinery required in the erection or extension of electric power stations. Great Britain gets her fair share of orders for boilers, but has only done indifferently well in orders for turbines and electrical machinery. The bulk of the orders are placed by the South Manchuria Railway, and wherever possible they are given to Japan. As the latter develops, trade with other countries will diminish and eventually be confined to special articles.

The B.E.A.M.A. Dinner.

The Future of Electric Power Supply.

THE annual dinner of the British Electrical and Allied Manufacturers' Association was held at the Connaught Rooms on November 17th, Lord DERBY, the President, occupying the chair. There were over 700 gentlemen present. After the loyal toast had been proposed by the chairman and honoured by the company, Lord WEIR, P.C., proposed the toast of "The Future of Power Supply in Great Britain." He said that he spoke with some trepidation, for he was responsible for the introduction of a scheme which had been calculated to bring in its train untold evil and misery. However, in the electricity supply industry action had at last superseded words, and there now existed a definite constructive policy. He would not deal with the actual subject of power supply, for that had been ably covered by Mr. Archibald Page in his address as President of the Institution of Electrical Engineers, but he would say that he believed the result of the new Act would be like a man's second marriage—the triumph of hope over experience. In the past, electricity supply had suffered from legislation, but the 1926 Act was remedial. The composition of the Central Electricity Board and the goodwill which it had engendered augured well for the success of the scheme. An industrial community's success was measured by its productivity, and the latter could be gauged by that community's consumption of energy. The scheme was designed for a progressive, not a degenerate, country. It left the distributor untrammelled by the worries of generation and enabled him to devote all his energy to the sale of electricity and the education of the people in its use—to instil electrical habits. The distributor and the consumer had a long way to go before the limits of the application of electricity were reached. In industry, transport and the home there were still hundreds of tasks which could be simplified by electricity, and we were only beginning to realise the possibilities of electric lighting. He urged the distributor to double his faith in the future of electricity supply and to act on that faith. The schemes of the Board were based on faith in the future of electricity. Could not distributors show their faith by fixing next year's price a little lower than last year's cost? They should go out for the business first and then make it pay. He was disappointed to find how few working-class homes were electrically equipped, and how difficult it was for them to obtain a supply. The working class load, although appearing unattractive, had proved to be a most valuable one. Lord Weir then dealt with the question of private generating plant. He asked the manufacturers to encourage the use of the national service in preference to private plant, for the only thing which would prevent the "grid" supply from being the cheapest supply was the perpetuation of private generating stations. The railways should revise their calculations in view of high-pressure energy becoming available all over the country at low prices. The mining and iron and steel industries would soon have a market available for their waste heat. There was no doubt that the electrical manufacturing industry of this country was able to undertake any orders which might be placed with it in the face of the keenest foreign competition. The success of that industry was largely due to the efforts of B.E.A.M.A., to whom credit was also due for its valuable statistical and propaganda work.

Sir ANDREW DUNCAN, chairman of the Central Electricity Board, responded. He said that a short time ago the Board had incurred the displeasure of B.E.A.M.A. for not insisting that only British tenders could be considered when orders were being placed. He hoped that when the Board came to place orders the result would justify B.E.A.M.A.'s faith in the quality and prices of its products. As the creation of his brain, the Board would endeavour to fulfil Lord Weir's hopes of its success. An abundant supply of relatively cheap power had been for more than a century a fundamental factor in the structure of our industrial enterprise. During the last 20 years electrical development had been rapid, and there was no new industry which had greater prospects. Electricity must play a decisive part in the resuscitation and expansion of British industry. The cost must be reduced; the saving of fractional parts of a penny was vital to the industry and the purchaser. The older basic industries were looking to electricity to help them to recover, and the future was dark unless those industries were revitalised. Electricity supply would also be a determining factor in the location and development of new industries. Price was all-important, and the manufacturers could play their part in the reduction of costs. There was already a preference for public supply; for many years the private user had felt that it was not right to add to his business cares the worries of generating electricity, and he looked to the scheme to give him a good public supply. In a very short time the distributing undertakings would realise the benefits of being freed from generating worries. Time and patience were necessary, for existing interests had to be considered and reconciled. With time, patience and earnest method on both sides accommodation should be possible to find, and success would be attained. There could not be the slightest doubt that, amid the uncertainties which now existed, the one certain thing was the future prosperity of the electricity supply industry and the manufacturers concerned with it.

Lord DERBY, in proposing the health of the guests, said that it was impossible to mention all the outstanding figures in that company. One at least, Lord Gainford, he knew well as an all-round man. The speaker recalled many of Lord Gainford's services to his country.

In responding, Lord GAINFORD said that England was not "going to the dogs," in spite of all the pessimists. Business men and farmers were invariably croakers—they always talked of their losses, but never of their gains. The coal industry had not stood still in the matter of electrification, as the official figures—which he quoted—proved. The industry was depressed, and it had been reviled, but it was not unique in the latter respect. Even the electrical manufacturing industry had had to spend money to prove its vitality and prosperity. The community was dependent upon electricity to a far greater extent than it appreciated; the speaker made particular reference to the use of electricity on board ships. He then said that the British shipping industry was showing considerable improvement; it was receiving the greatest share of the world's construction, and was still the leader in the world's carrying industry. Although the basic industries had been through a depressing period, many of the newer industries, such as electrical manufacturing and the motor-car trade, were expanding rapidly. In the South of England employment was increasing. There were signs of a great expansion in electricity supply, and that would be stimulated by reductions in the costs of transmission lines, which had proved a retarding influence. One of the most notable facts of the present day was the growth of confidence between industries and between employers and employed. He believed that our problems were being solved more rapidly than was generally realised. We had lost ground not only on account of the war, but by our inability to adapt ourselves to the changed post-war conditions. That was being altered, and to-day employers were convinced of the necessity of co-ordinating their interests. The Federation of British Industries, founded in 1916, had increasingly grown in strength, and was now a most important factor in the industrial life of the country. The speaker did not think that too much could be expected from trusts and cartels; they tended to lead to inflated prices which would eventually

curtail production. In conclusion, he said that the magnificent work done by B.E.A.M.A. had placed the British electrical manufacturing industry in the front rank.

Col. R. K. MORCOM, chairman of the Council, proposed the health of the Chairman, who, he said, radiated good fellowship, which was never more essential. He proceeded to deal in a humorous manner with the position of affairs as the electrical manufacturer viewed it. British manufacturers, he said, had to pursue their vocation in a heavily-taxed country, and they were surrounded by monopolies. They were told that association was essential, but their mildest efforts at co-operation were met with yells of disapprobation. He then went on in a Euclidean vein, putting forward some axioms, postulates, definitions, theorems and problems. One of his axioms was: "The price of the finished article must be less than the sum of its materials." He postulated a "quota scheme" as "A fair division of labour only permitted to railway companies." A theorem was: "If a customer having bought abroad immediately attacks the B.E.A.M.A.: Prove that the virulence of his attacks is in direct proportion to the shame which he feels at his action."

Lord DERBY briefly acknowledged the toast, and, in doing so, referred to the good work of the director of B.E.A.M.A. (Mr. D. N. Dunlop) and his staff.

The Transport Congress.

Electrical features of the exhibition and proceedings of the Public Works, Roads and Transport Congress.

THE fourth Public Works, Roads and Transport Congress and Exhibition was held at the Royal Agricultural Hall, Islington, last week; the first event was in 1915. Something like 2,000 delegates took part in the proceedings, which naturally covered a very wide field, a great many of whom came from oversea or represented local authorities.

At an official luncheon on the opening day of the Congress, Sir Henry Maybury, K.C.M.G., Director General of Roads, Ministry of Transport, expressed the hope that the Congress would be a big step towards the establishment of a chair of highway engineering at the University of London. About £45,000,000 per annum was spent in this country on roads by some 2,000 local authorities. We had the best system of roads in the world. Since 1920 some 200 miles of new arterial roads had been constructed in the London area.

Abstracts of some of the papers and brief particulars of some of the electrical exhibits follow.

Street Lighting Regarded as an Illumination Problem.

By J. W. T. WALSH, M.A.

(Abstract.)

One of the reasons which may be adduced for the exceptional difficulty of the street-lighting question is the fact that a clear statement of the problem itself has not yet been put forward. It is not sufficient to say that what is required is easy recognition of objects on the highway, and of irregularities in the surface of the road, unless some method can be indicated by which this statement can be translated into terms of polar distribution, mounting height, spacing, &c. Under normal conditions, objects are seen by reason of the contrast they present with their background. The ability to perceive a given contrast depends on the brightness of the objects viewed.

The visibility of objects on the highway increases both with the brightness of the field of view and with the contrast between the objects and their background, *i.e.*, the road surface; this statement, must, however, be enlarged to take into account the important factor of glare which can never be neglected in practical street lighting. Bordoni and Holladay found that, at any rate to a first approximation, the effect of the glaring source depended solely on the illumination it produced at the observer's eye, and not independently on its brightness, its size, or its distance from the observer. This leads to the important result that the use of obscuring bulbs or diffusing-glass bowls surrounding the light sources cannot mitigate the glare except by reducing the candle-power in the direction of view. It should be noticed, however, that this conclusion has been arrived at only with regard to the capability of the eye to discern contrasts.

In order to determine, for any specified system of street lighting, the contrast which a given object will present with its background at various positions along the roadway, it is clearly necessary to make certain assumptions as to the nature of the road surface and of the objects to be perceived. There can be no question of control over the reflection characteristics of the objects, and all that can be done is to assume a fair average figure for the reflection factor; it is probably not unreasonable to assume 7 per cent. As far as the road surface is concerned the matter is one of even greater difficulty.

It might be concluded that the best form of street lighting would be that in which bright patches in proximity to the street lamps were separated by stretches of very poorly lighted roadway. Further consideration, however, will show that this is not the case, for the visibility of an object depends on the general brightness of the background as well as on the contrast. The lower the general brightness the greater the contrast necessary for visibility and it may well happen that a small object is viewed against only a limited stretch of road. Moreover, when the background itself is patchy, the object consists of large numbers of alternately bright and dark horizontal strips (as compared with its background) and the visibility of the object is exceedingly poor. In fact, the discernment of a small object on a very uneven background is quite as difficult as the discernment of an object which is itself very uneven in brightness, a difficulty which is the underlying principle of concealment by so-called "dazzle-painting."

In the case of electric vacuum lamps the filaments are usually vertical and about two inches long, and in order to get the best results the shades would have to be carried out so that they were 20 in. from the lamps. This might prove a serious objection, and it is fortunate that this type of lamp is rapidly being replaced by the modern gasfilled lamp in which the filament is disposed in the form of a horizontal ring of from 1 to 1¼ in. in diameter. It is clear that with a light source of this form a very sharp cut-off indeed would be obtained by means of shades placed at a distance of about 10 in. from the centre of the lantern. Unfortunately it is at present necessary to contemplate variations of about 0.8 in. in the light-centre lengths of these lamps. The only solution of the difficulty would seem to be either the selection of the lamps used so as to make the variations in light-centre lengths to be allowed for very much smaller than the 0.8 in. allowed in the British Standard Specification, or, alternatively, the use of a shade of greater diameter. It should be noted that the variation of light-centre length is also a very serious drawback when any optical reflector or refractor system is used to give a concentration of light in a specified direction.

The Street Lighting of London.

By W. J. JONES, M.Sc.

(Abstract.)

Street lighting appropriations are entirely inadequate to meet present-day requirements; throughout England the appropriation amounts to only 5.3d. in the pound, or less than one halfpenny in the pound per month.

Good street lighting involves two considerations on the score of visibility, that of distinguishing detail at close quarters, and that of rendering a fairly large object visible at a distance. It is well known that visibility is greatest when there is a complete absence of abnormally bright light sources in the direct line of vision. The following general recommendations can be made in those instances of distant visibility being the prime factor of importance:—

1. The road or other surfaces in the line of vision should be sufficiently well lighted.
2. The light source should be mounted as high as possible to avoid subtending a small angle with the object.
3. The candle power of the light in the direction of the observer should be such that the glare produced is a minimum, *i.e.*, illumination reaching the observer from the light source should be rigorously controlled.

Apart from the classification of streets and the provision of sufficient light, there are several matters of importance which may materially influence the excellence of an installation. As a general rule, there is relative freedom in the method of installation that can be employed, depending, of course, on the type of lantern and the polar curve of distribution that it gives. There are, however, certain circumstances where central suspension or central mounting would be definitely advantageous. Central suspension in narrow, busy roads facilitates even distribution of light along the street, and avoids obstructions to pedestrians and road traffic.

The importance of the building reflecting surfaces in the vicinity of sharp turnings, or in those situations where one road leads directly into another at right angles, cannot be too strongly emphasised. It might be advantageous in many instances to definitely arrange for such surfaces in the direct line of vision to be painted in some light colour.

At the present time street-lighting conditions in London are "patchy," and the problem is further complicated by

the fact that the jurisdiction of any particular lighting authority is strictly limited to its boundaries. In view of the miscellaneous system of lighting employed in London, it is not surprising to find that the cost of lighting per mile also shows great variations. In Bethnal Green street lighting costs £106 per mile per annum, while in the City of London it costs £588 per mile per annum, at St. Pancras £474 per mile per annum, and at Westminster £353 per mile per annum. The lighting rate averaged throughout London is only 3d. in the £.

The author makes the following tentative proposals for constituting a street-lighting authority for London :—

1. A central organisation under the London County Council to have the over-sight of all street-lighting problems in the London area. This organisation to be controlled by a street-lighting board representative of the existing lighting authorities.
2. The organisation to be constituted on somewhat similar lines to that already existing in Glasgow; the administration to be carreid out by a senior officer with assistants who would be responsible for various areas or special aspects of public lighting. Each superintendent of lighting for a given area to be in charge of depôts and responsible for the street lighting in his area, both as regards new work and maintenance. The senior officer to be responsible to the abovementioned committee for the efficient working of his department.

Discussion of Dr. Walsh's and Mr. Jones's Papers.

Capt. W. J. LIBERTY (Institution of Public Lighting Engineers), referring to Mr. Jones's proposal for one control body for the London street lighting, pointed out that since 1909 the Illuminating Engineering Society had been striving as hard as it could to bring the lighting of London streets up to a proper level, and the Institution of Public Lighting Engineers had also recently fought for this object. He thought Mr. Jones would have helped his readers more if he had showed the ratable values of the London boroughs. In the City of London, where a penny rate would bring in about £34,000, only about a .9d. rate was spent on street lighting.

Mr. J. E. RITCHIE (General Electric Co., Ltd.) suggested that the lighting of a road was as important as the method of its construction. He was one of the small group of people who had been trying to prove that absolute uniformity of illumination was not the very first thing which was desirable. Street lighting was an exceedingly complex and scientific matter, and contracts should be placed with that fact in mind.

Mr. LEON GASTER (Illuminating Engineering Society) said the trouble was that the question of street lighting was one about which few people knew anything, and it was often in the hands of such people. We had new problems in street lighting to-day and absolutely new conditions to work under. He suggested that they should endeavour to convince the Minister of Transport that some of the money collected from the users of vehicles should be devoted to street lighting.

Mr. HAYDN HARRISON said that if measured by the best standards of illumination existing to-day, then there had been a great deal of progress; but if measured by the average standards, then there had been little or none. As regards glare, he thought the psychological factor was very important. They had to take the views, not of lighting engineers, but of the majority of people. He had made an experiment in which he illuminated one end of a street with naked lamps and the other end with lamps with diffusing globes, the source of light being equally strong in each case. The members of his Committee who viewed each end of the street all preferred the lamps with diffusing globes, from the point of view of minimum glare.

Mr. COLQUHOUN (Sheffield) said he had found that the discomfort arising from a plain gasfilled electric lamp was altogether out of proportion to that coming from a frosted electric lamp. He thought that showed that the source of light had something to do with glare. He thought Mr. Jones was an optimist in placing cost seventh in the list of requirements for street lighting. In his experience he had found that the cost came first and remained first.

Mr. L. G. W. JOLLEY (General Electric Co.), referring to Dr. Walsh's remarks on reflection from the street surface, said there was a system of street lighting in America by means of which the reflection from the street surface was utilised to assist the illumination of the street, and thereby also, to lower the consumption.

Mr. A. C. CRAMB (President, Institution of Lighting Engineers) said that not only was more illumination of the roads required, but a constant degree of illumination over the whole route. One could go from the centre of London and pass over certain sections of the road where the variation in illumination was very great. He proposed that the control board suggested by Mr. Jones should be under the supervision of the L.C.C. He was glad to see that in Dr. Walsh's paper some encouragement was given to those who did not believe in an absolutely uniform standard of illumination, and he thought they must not be carried away by the glare question.

Baillie MCDOUGALL (Glasgow) said that in his city they were embarking on a programme in which they looked two years ahead. Where they had erected new little towns under their housing schemes, each with a population of 15,000, they had felt it their duty to see that these places were properly illuminated.

Replying to the discussion, Dr. WALSH said that it seemed that, after all, the question of glare and flicker was a psychological one. As regards the illumination of roads above the surface and the desirability of illuminating the faces of people, they had to consider the prevention of light getting into the eyes of people, and they had to try to preserve a balance between two evils.

Mr. JONES said he was of the opinion that a central lighting authority for London should have definite control, and not merely advisory powers. It should be in the position to undertake research work in a way which the many existing lighting authorities could not do, each acting on its own. He definitely associated himself with Dr. Walsh on the question of glare.

Present-day Implications of Transport Undertakings.

By H. MARSH.

(*Abstract.*)

It is frequently suggested that, with the extended use of the motor-omnibus in recent times, tramways are fast becoming obsolete, and the point arises as to whether a complete or partial "scrapping" of existing systems is practicable. A solution in many cases has been found in the adoption of the trolley vehicle, which does not necessitate the complete abandonment of valuable plant, or again, with a view to providing more comprehensive transport facilities, it may be possible to supplement existing tram services by the employment of 'buses—which would feed outlying districts in an effectual manner. By co-ordinating the two means of transport the retention of the trams would in all likelihood be assured for an indefinite period.

As to facilities, tramways ensure to their patrons a comfortable, frequent, and thoroughly reliable service. A distinct weakness—and one that obviously cannot be overcome—lies in the inflexibility of their routes. For all that, the tramcar is still unrivalled.

A belief that new tramways are unlikely to be constructed seems to be based more upon their so-called "practical limitations" than upon the real stumbling-block, high installation costs.

In the large cities of Germany, apart from "touring" motor-coaches, motor-omnibus services are the exception rather than the rule. To the impartial observer this state of affairs seems in many respects to be almost a blessing in disguise, for there is an amazing absence of the congestion that is associated with our large centres.

In America, the consensus of opinion expressed by those having experience is that the 'bus cannot replace the electric tramway for ordinary city purposes. Incidentally, it should be said that in the United States municipal ownership of "street railways" has not yet made great strides, that is to say, when compared with the position in this regard to England.

Coming back to this country, it is of interest to notice that there are still municipalities to be found which are not disposed to be stampeded into abandoning tramway systems that are giving efficient services. For example, the Corporation of Plymouth recently placed an order for a number of tramcars of up-to-date make, an indication that the tramways have not outlived their usefulness.

Many municipalities, as a result of growth of population and a concurrent expansion of their boundaries, are faced with new problems. A local authority may find its transport arrangements inadequate, or where the need for extended facilities has not yet arisen, the ordinary and inevitable effects of wear and tear frequently compel local authorities to consider the reconstruction of tramways. The trolley vehicle has in many cases provided a way out of the difficulty—although whether it will prove a permanent solution is quite another matter.

Although trolley vehicles have been found to give satisfactory service where the traffic is not too heavy, no local authority would consider their adoption for a moment if this entailed the initial installation of standards, wires, and cables. It is impossible, therefore, to say that this system of traction has any sort of assured future.

The competitive element enters a good deal into the operation of tramways and omnibuses in many districts, and without question there must be definite co-operation between the purveyors of these services if the maximum benefit is to accrue to users. A spirit of narrow opposition to private enterprise is too often manifested, without any recognition of the fact that the latter frequently attempts—and, indeed, adequately fulfils—tasks that would otherwise be left undone.

Lord Ashfield, chairman of the Underground Group of Railways, recently stated that his companies supported the proposal of the London and Home Counties Advisory Committee that there should be common management and a common fund for transport in London. This pronouncement can only be construed as a full and frank admission of the need for co-operation, as well as for a greater measure of public control, in the conduct of the London traffic services, and coming as it does from one of the strongest advocates of private enterprise, is not without significance.

It is seriously suggested that the only practical and permanent solution of the question is to be found

in a national policy which will secure statutory regulation and correlation of all passenger road services, whether municipally or privately owned. A national scheme of this kind would be beneficial to municipal and private operators, as well as to the general public.

Cleansing.

By W. WEAVER, B.Sc., A.I.C.

(Extract.)

Much useful reform could very well be introduced in many towns and cities with regard to the organisation of the collection system in vogue for house refuse. The electric vehicle as a unit in refuse transport is steadily gaining favour on account of its general efficiency and reliability. Its opponents are usually lacking in the technical knowledge necessary for the running and upkeep of a fleet of such vehicles. Statistics reveal the remarkable freedom from breakdown of the electric vehicle, and although experience with a large fleet is as yet limited, figures so far compiled indicate low tire wear and long battery life. On collection journeys of over 1½ miles the horse vehicle is easily beaten by the electric vehicle on costs, and authorities on this method of transport are of the opinion that for the shorter journey also the horse vehicle must ultimately take second place. A feature of the electric vehicle which demands attention is the present usual loading height of the body. A considerably lower body height should claim the attention of electric vehicle designers in the future, to speed up the rate of collection. At the same time there is an optimum height above ground, below which offence might be given to passers-by on æsthetic grounds. It therefore behoves designers to seek the happy mean.

The big, roomy body of the electric vehicle, together with the fact that it carries with it an easily controlled and adaptable source of energy in its batteries, should surely give designers further incentive towards the accomplishment of that long-desired invention—a method of dustless loading. It is surely a reform long overdue that the ratepayer should be given a service as cleanly performed in this branch of public work as in any other. That a vehicle capable of being loaded without the dust nuisance referred to, and whose contents are out of the public view, can be produced, is proved by experience in Germany and Austria. In both these countries dustless loading vehicles made by Krupp's are in satisfactory operation; it is therefore up to our designers to produce a similar or better vehicle with its inherent benefits for the English people.

Exhibition of Apparatus.

As a whole, the exhibition, from the electrical point of view, was somewhat disappointing. Full advantage does not seem to be taken of the electric drive for road-making machinery. Such apparatus as concrete mixers and stone-crushing machines, where the advantage of electric driving is so pronounced, was nearly all shown equipped with oil engines, although in many cases electricity was resorted to as a temporary driving means.

An unusual exhibit by Messrs. REAVELL & Co., LTD., was a portable air compressor, designed primarily for tramway track repairs, shown exactly in its working condition after a few

Fig. 1.—Electric Garage Pump.

years' service on a large tramway undertaking. Over 30 of these sets have been supplied to the Metropolitan Electric Tramways Co. The compressor is suitable for a working pressure of 80 lb. per sq. in., running at 575 r.p.m. The 13-h.p. driving motor is of the "Emcol" totally-enclosed type, and is provided with special cooling arrangements. A feature of the outfit is a connection for taking a supply from the overhead system without interrupting the tramway service. Another item shown by this firm was a small electrically-driven garage pump, fig. 1. This machine, it is claimed, will inflate an average motor-car tire from dead flat to 80 lb./sq. in. in 1.75 min. The maximum working pressure is 150 lb. per sq. in. The set can be supplied for d.c. at a pressure between 100 and 500 V, or for a.c. for practically any standard supply. The driving motor is of ¾ h.p., and the net weight of the complete outfit is 200 lb.

An interesting exhibit among the heavier class of equipment was the Parsons trench-excavating machine, shown by Messrs. JOHN ALLEN & SONS (OXFORD), LTD. This should prove of interest in connection with electric cable laying for extensive distribution schemes. The machine, which could be easily adapted to electric drive, is capable, it is claimed, of digging a trench 7 ft. deep and from 1 ft. wide at the rate of 100 feet per min.

On the stand of Messrs. FREDERICK PARKER, LTD., was seen the "Monarch" electrically driven stone breaker. This is equipped with a revolving-type screen which distributes the material into various heaps according to the sizes of the perforations in the drum. The driving unit required is of about 15 h.p., and the machine is designed to deal with eight tons of road material per hour.

The Mangnall-Irving thrust-boring outfit shown by the HYDRAULIC ENGINEERING CO., LTD., attracted considerable interest. The latest model of this equipment uses oil instead of water, and is fitted with an ingenious "fool-proof" detector mechanism, whereby an alarm is sounded the moment, it is claimed, the boring pilot touches a gas or water pipe, or the lead sheathing of an unarmoured cable.

One important feature of the exhibition as a whole, from the electrical point of view, was a 30-cwt. electric vehicle shown by Messrs. ELECTRICARS, LTD. This is a low-loading vehicle specially designed for the collection of house refuse. The loading line of the body is arranged at the correct height to receive a bin from the loader's shoulder without lifting or stooping. The body tips endways by electric or hand gear. The vehicle may be fitted with either the Edison or lead-type battery, which is housed in a sheet-steel box forming the driving seat. The average full-load speed claimed for the vehicle is 9 to 10 m.p.h., and the miles per charge, 25 to 30.

A number of firms which displayed oil engines suitable for driving small electric generators included Messrs. RUSTON AND HORNSBY, LTD., and Messrs. PETTERS (IPSWICH), LTD.

Among a variety of other apparatus, Messrs. BAIRD AND TATLOCK (LONDON), LTD., showed some electrically heated ovens for dealing with road-preparation materials; these are capable of being heated to and maintained at any temperature between 25 and 275 deg. C.

Messrs. RICHARD HILL & CO., LTD., showed some interesting samples of their "Maxweld" electrically welded fabric for reinforced-concrete roads.

Included in the few electrical instruments which were seen at the exhibition was electrical remote-recording apparatus for use in conjunction with a Venturi meter. A float on the mercury column works through a rachet and pinion device a variable resistance in the circuit of the recorder. The resistance change is proportional to the rise and fall of the mercury, and hence to the rate of flow and quantity of the fluid to be measured.

On the stand of the CAMBRIDGE INSTRUMENT CO., LTD., was seen an interesting group of instruments—vibrographs, accellerometers, and stress recorders—in which the records are obtained by the action of a moving stylus upon a transparent celluloid film. Owing to the low elastic limit of the material plastic deformation of the celluloid surface occurs under comparatively low pressures, and by using a stylus having a minute spherical point, smooth plastic flow of the material is obtained with an extremely small expenditure of energy. The line produced possesses unique characteristics which render it possible, it is claimed, to enlarge the records to a considerable extent by means of a microscope, or by photography. The records can be removed from the instrument and examined immediately after they are made, without chemical treatment or the use of a dark room. There is thus a considerable saving in time, as it is possible to see at once whether a proper record has been obtained of the desired phenomena, and the programme of work can be adjusted accordingly. A number of typical records of vibrations, accelerations, and stresses taken with these instruments under various conditions form an interesting part of the exhibit.

An electrically driven tamping machine was shown by Messrs. B. JOHNSON & SON. This "Midget" machine is designed on the "pile-driver" principle for consolidating the refilling of trenches up to 2 ft. 6 in. wide.

Electric flashing road beacons were shown by Messrs. BARBER & COLMAN, LTD., and by the GAS ACCUMULATOR CO., LTD.

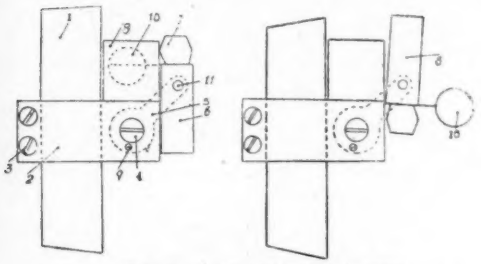
The HORSTMANN GEAR CO., LTD., exhibited a comprehensive range of time switches and fittings for electric street lighting. A feature was a time-switch unit complete with fuses and housed in the casting of the fitting. The unit employs the double plug-in principle, the base, comprising the switchgear and fuses, plugging into conveniently arranged sockets in the housing, and the clock plugging into the base.

New Electrical Devices, Fittings, and Plant.

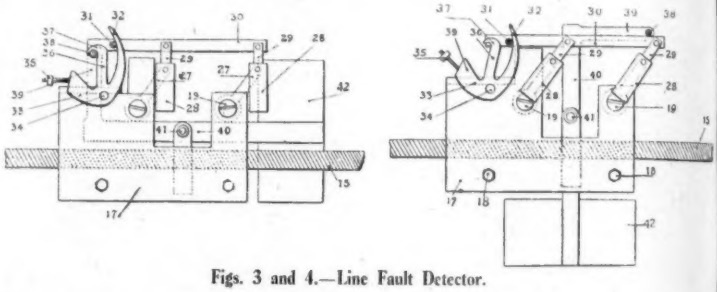
Readers are invited to submit particulars of new or improved devices and apparatus for publication in this Section.

Cable and Line Fault Detectors.

Our French contemporary, *L'Electricien*, describes two fault detectors which have recently been brought out by M. Charles Demont, of 3, Rue St. Genois, Lille, for use on circuits loaded to over 50 A. The apparatus is simple, yet of substantial construction. One detector is for underground cables and the other for overhead lines. The underground detector consists of two plates of iron-steel magnetic metal 2, mounted one on each side of the conductor 1, the two plates being connected at one end by screws 3, and at the other by a non-magnetic screw 4. Between one of the plates and the conductor is fixed an arm 5, carrying at its upper end a short tube 11 which serves as a sleeve



Figs. 1 and 2.—Cable Fault Detector.



Figs. 3 and 4.—Line Fault Detector.

for a U-shaped stirrup of magnetic metal 6. This is provided at its upper end with a counter weight 7, and at the side with a short rod on which is mounted a light metal disk 10, painted a bright colour. At rest, and when current is passing in the conductor, the parts of the detector occupy the position indicated in fig. 1, the disk being hidden behind the guide plate 8 which also controls the position of the stirrup in relation to the plates. In the event of a fault the flux in the plates increases and attracts the stirrup, with the result that the counterweight tips over, causing the parts to assume the position shown in fig. 2. The disk is then clearly visible, and gives an indication of the passage of an abnormal current in this section of the conductor. When the fault has been remedied the parts of the detector can be put back to their normal position by means of an insulated rod. The idea is to install a detector at each of the sectionising points of a cable where they pass out from the ground to a sectionising box, so that the location of the fault can be facilitated, it being between the last detector operated and the first remaining normal.

For overhead cables the detector shown in figs. 3 and 4 is supplied. In this device two magnetic metal plates 17

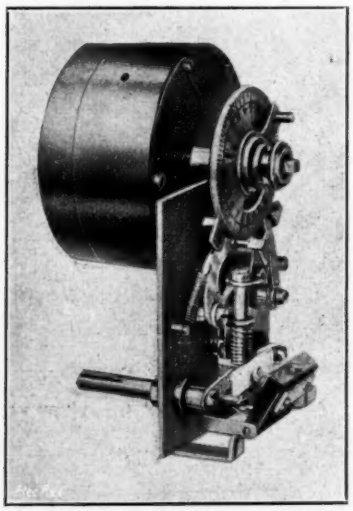


Fig. 5.—"Brinkman" Time Switch.

are fitted round the conductor. Magnetic and non-magnetic screws are again used to secure the plates in position. To the plates arms are secured on which are pivoted stirrups 28, the upper ends of which are provided with yokes 29 connected with a cross number 30. At one end of the latter is a stop pin 31 which controls a specially shaped piece 33 pivoted at 35 on the plates and furnished with an adjustable counter-weight 35. The piece 33 also comprises a hook-ended arm 37 which holds the piece on the pin 38. The latter is mounted on the end of an arm 40 connected by the pivot 41 to a yoke on the plates 17, the arm having at its other end a bright painted disk.

The operation of the detector is as follows: When the current passing in the conductor is normal, the apparatus occupies the position indicated in fig. 3; the pin 38 is held by the hook 37, the disk 42 being hidden. When a fault occurs, the resulting flux in the plates 17 causes the stirrups to take up the position shown in fig. 4. Displacement of the arm brings the indicating disk into prominence. It is intended that the overhead line detector should be fixed near a supporting mast, so as to facilitate the readjustment of the apparatus after it has, owing to a fault on the line, functioned. Except the disk and its arm, the mechanism of the overhead line detector is entirely enclosed as a protection from the weather.

A New Time Switch.

We have recently had occasion to examine the new "Brinkman-E.C.L." time switch, fig. 5, 250 V, 5 A, which has been recently marketed by Mr. E. BRINKMAN, 26-27, Hatton Garden, London, E.C.1. It is a well-made instrument, incorporating several new features. It has been specially designed for street and shop-window lighting, and electric-sign control, and the manufacturer claims that it is an advance on any other time switch. The materials are of high quality. The mechanism is of phosphor-bronze throughout, an alloy that will stand a great deal of wear. In mounting the mechanism on an insulated brass plate rigidity is ensured. A simple patented non-arcing device is incorporated, consisting of a piece of non-conductive, non-fusible material between the gold-and-silver alloy contacts. The movement is instantaneous and is brought about in the following manner, see fig. 6. As the shaft D is raised so the contact bridge G falls away, and the "break" piece X is introduced instantaneously between the terminal contacts at E, thus cutting the circuit and arc. The usual danger of an arc forming as the circuit is broken is therefore eliminated. The contacts, when not under load, are always protected and insulated, thus allowing the switch to be used

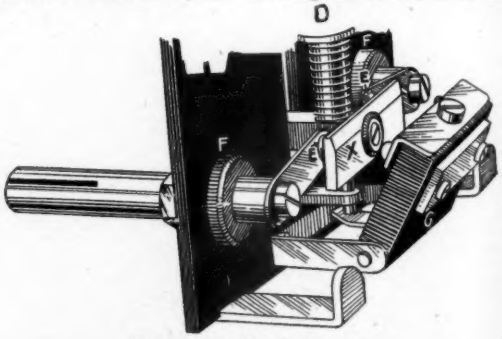


Fig. 6.—Time Switch Movement.

in any position. To actuate the mechanism a very efficient clock is employed, designed to fulfil its work, it is claimed, regularly and punctually under varying atmospheric conditions. A fully jewelled lever escapement Breguet-type hair spring is used for the purpose which is non-rusting non-magnetic and has an infinitely small temperature error. The dial, divided into 24 hours, can be set to a fine degree of accuracy. The whole unit can be removed at once from its aluminium die-cast box without interfering with the circuit connections, the plug-in feature having been adopted. The casing is hermetically sealed and weather-proof.

Selected Radio-Telephone Apparatus.

Recent Developments and Improvements.

New Mullard Products.

The MULLARD WIRELESS SERVICE CO., LTD., recently placed on the market a new valve of the "super-power" type, which, like others of the P.M. series, works at a very low temperature. The filament current is 0.3 ampere at 2 volts, and the new valve is designed primarily for use in the last l.f. amplifying stage of a receiver; having a large "grid base," it is capable of handling powerful signals, but it is essential to employ the correct negative grid bias as follows:—

Anode voltage.	Negative grid bias voltage.
50	4.5
75	7.5
100	12.0
125	15.0

At an anode voltage of 100 V (zero grid voltage) the anode impedance is 3,800 ohms, the amplification factor being 3.8 and the mutual conductance 1.0 mA per volt.

Fig. 1.—New Resistance-capacity Coupler.

The Company is also making screened valves of an unusual pattern. The internal screening covers the whole of the valve, so eliminating the need for external screens; and the fifth terminal is brought out through a moulded cap at the top of the glass bulb, the base being of the usual 4-pin type. The filament currents of the 2-, 4-, and 6-volt patterns are 0.15A, 0.075 A, and 0.075 A, respectively, the amplification factor being stated to be 200 in each case, while the anode a.c. resistance is 250,000 ohms in the case of the 2-V valve, and 200,000 ohms in that of the 4- and 6-V ones.

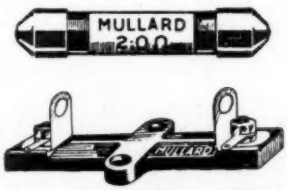


Fig. 2.—A New Grid-leak and Holder.

The Mullard Company is marketing a new type grid leak and holder, which in external appearance is similar to others, but consists of a constant high-resistance element on a core of glass, the combined core and resistance element being mounted in an ebonite tube fitted with nickel caps, fig. 2. They are made in 7 values as follows:—0.1, 0.5, 1.0, 2.0, 3.0, 4.0 and 5.0 megohms, whilst intermediate values can be supplied when specially ordered. The holder is robust, the bakelite base being fitted with both terminals and soldering tags.

The new P.M. resistance-capacity coupling unit (fig. 1) has been made to match PM.1A, PM.3A, and PM.5B valves, and the mica condenser capacity is such that there is no appreciable "cut-off" of the lower notes. One of the greatest advantages of resistance-capacity coupling is the manner in which it amplifies the lowest and highest frequencies to an equal extent; this, however, may actually to a certain extent be a disadvantage, in that the radio-frequency component of the anode current of the detector valve may be amplified by successive stages to such an extent that distorted reproduction may result. Therefore, in the new coupling unit two separate devices are incorporated to guard against any radio-frequency oscillations passing through into the low-frequency amplifying stages. The device is compact, and may be easily substituted for an intervalve transformer. It is provided with four terminals marked P, G, +B, and −C, corresponding to the four transformer terminals.

The "Thermattaix."

Messrs. ATTAIX, LTD., are attempting to solve the problem of providing an adequate supply of power for the operation of radio receivers in an unusual way, by the production of the "Thermattaix," illustrated in fig. 3, with and without its perforated-metal cover. It is a thermo-electric generator made up of a number of compound metal strips, all connected in series as shown: two differently composed metals are coupled together, one thermo-couple being heated while the other remains cold, the difference in temperature between the two setting up a flow of electric current. The 2-volt pattern is composed of 140 strips, or 70 strips per volt, so that the strain on each strip is very small. It is understood that the device is to be made in 2-, 4-, and 6-volt sizes with an output

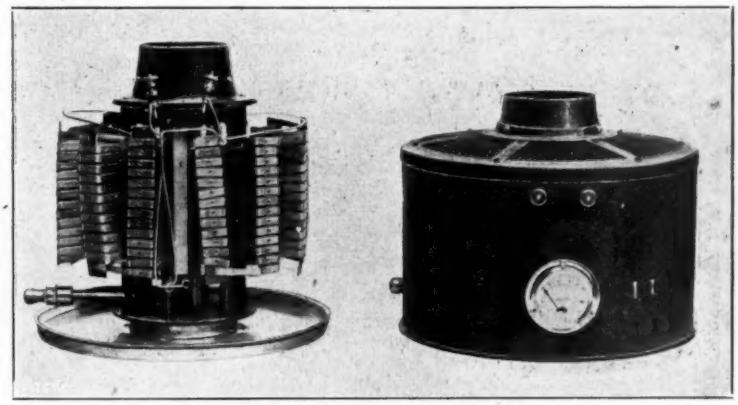


Fig. 3.—The "Thermattaix" Current Generator.

of from 0.3 to 1 ampere, and is operated by the direct application of heat to the strips, either electrically, by means of a flame, or even the exhaust gases of an engine, &c. The 2-V 0.5-A sample sent us is gas heated, it having a vertical burner at the centre; it is neatly made and not bulky, being about 11 in. in diameter and 9 in. high. It will be appreciated that the "Thermattaix" does not contain any moving or other part which is liable to go wrong, there should be no risk of electric shoock, and there can be no hum.

Nickel Filament Valves.

The BRITISH THOMSON-HOUSTON CO., LTD., has sent us some samples of a new series of valves, the filaments of which are made of nickel, a metal that has not hitherto been used for the purpose. The filament can consequently be made long, so that greater emission and a longer useful life result. They are at present available in three types: high-frequency, B.210H, with a 2-V, 0.1-A filament and 150-V anode; detector, B.210L, with a 2-V, 0.1-A filament and 120-V anode; and a power amplifier, B.215P, with a 2-V, 0.15-A filament and 120-V anode. Other characteristics of the new valve are:—

	B.210H.	B.210L.	B.215P.
Amplification factor ...	35	13	7
Anode a.c. resistance ...	87,500	14 000	7,000
Mutual a.c. conductance	0.4	0.9	1.0 mA per volt.

The above average constants were determined at $E_a = 100$ and E_g = zero.

Filament Fuses.

Messrs. Philips Lamps, Ltd., are marketing two patterns of radio fuses: No. 455 is in the form of a wander plug, which is inserted in the negative lead of the anode battery and safeguards the valve filaments. No. 374 has nickel fittings, and screws on to the panel; the fuse wire is contained in a glass tube with metal end-caps, and held between spring clips.

"N.A.D." Ebonite.

Introduced only five months ago, the popularity of ebonite with a wavy (No. 1) and speckled (No. 2) surface has induced Messrs. McLeod & McLeod to offer another pattern, namely, cube (No. 4); this high-grade, cheap, material is of very attractive appearance, and the company aims at delivering all B.E.S.A. and other good selling sizes from stock.

Radio Atmospherics.

The practical aspects of the problem, with particular reference to the transatlantic telephone service and directive spaced aerials.

By Lieut.-Col. A. G. LEE, O.B.E., M.C., B.Sc., M.I.E.E.

(Abstract of Chairman's Address before the WIRELESS SECTION *of the* INSTITUTION OF ELECTRICAL ENGINEERS.*)*

AN atmospheric has a peak voltage of the order of 0.1 volt per metre, and a duration of the order of 0.003 sec. Considerable variations from these figures occur and atmospherics sometimes have a fine ripple structure superposed upon the main wave-form. It is understood that the wave-form is being submitted to further analysis in order to ascertain, amongst other things, what effect the ripple structure has upon wireless receivers. Pending the result of this investigation, the atmospheric may be represented by an aperiodic or quasi-periodic voltage of an order of strength very considerably higher than any ordinary commercial wireless signal

The cathode-ray oscillograph, used as a direction finder (lent by the Radio Research Board) has been used at Cupar, Fife, to determine the direction of arrival of atmospherics: two frame aerials were set at right angles and connected through similar amplifiers to the four plates of the oscillograph; the beam of light acts like a pointer to indicate the magnitude and direction of the fields set up by an individual atmospheric; an observer notes the angle and the magnitude of the flash. The instrument used gave an ambiguity of 180 deg. in the direction of arrival of atmospherics, but this caused no real difficulty because the approximate direction was known; there is no evidence of the daily cum-solar swing of atmospherics, but the effects are probably complicated by the presence of thunderstorms on the Continent, which are more prevalent during the summer. At Cupar the signal arrives from a direction 11 deg. north of west, and the direction of arrival of atmospherics is given with reference to this direction as a base line. The angle between 140 deg. and 260 deg. is subject to attack from atmospherics at different times during the working period of the circuit (which is open for traffic from midday to 11 p.m.) whilst the angle between 310 deg. and 130 deg. (which includes the signal) is relatively very free from atmospherics; the worst directions are between 170 deg. and 230 deg. North Germany and Russia are the principal sources of these atmospherics. Atmospherics are generally weaker in Scotland than in the south of England; in addition, the Scottish locations are slightly nearer America, and the signal strength obtained there is greater than that at Wroughton, so that the signal-noise ratio at Cupar, near Dundee, is nearly four times better than that obtained at Wroughton, whilst at Thurso in the extreme north of Scotland it is nearly eight times better. The cause of the reduction of atmospherics in the higher latitudes is probably the increase of distance from the principal sources of atmospherics, which are known to be more numerous as one approaches the tropics from the polar regions.

Effect of Rainstorms.

When the strength of the incoming signal is only a few microvolts per metre, as it frequently is on the transatlantic telephony service (sometimes dropping to 0.5 microvolt per metre) considerable amplification has to be employed in the receiver. In these circumstances the occurrence of electrically-charged rain disturbs the antenna systems, manifesting itself as a hissing sound, at times sufficiently strong to put the service out of action. Not every rainstorm has this particular property, and it is only the combination of electrically-charged rain and a weak signal which causes difficulty. The use of large frame aerials, spaced apart to give directional properties, will, it is hoped, remove this source of trouble.

Spectrum of Atmospherics.

An aperiodic pulse can be represented by the Fourier integral of an infinite spectrum of continuous sinusoidal components. Assuming that the atmospheric is wholly represented by an aperiodic or quasi-periodic disturbance, then its effect on a wireless circuit is such that if the latter is designed to admit a signal with just sufficient of its side bands due to modulation to render it intelligible, then the circuit will also admit the sinusoidal components of the atmospheric pulse which lie within the resonance curve of the apparatus, and it is impossible to exclude them by processes dependent upon selectivity. This theory therefore removes from the discussion the numerous atmospheric eliminators which have been patented in the past, and enables one to design a straightforward filter circuit which will allow of the reception of the signal with a minimum exposure to atmospheric attack; the only effect of the presence of ripples would be to alter the magnitude of the atmospherics observed on a particular wave-band used. So far, evidence shows that the change of the spectrum with frequency is smooth and no marked disturbances at particular frequencies have been found. It is desirable, however, to await the application of more refined means of analysing the spectrum of atmospherics before forming fixed conclusions on this point. Evidence which indicates that the spectrum changes at different times of the day may be explained by the differing attenuation for various frequencies in propagation, so that at night time a greater proportion of the higher frequencies would be expected to arrive, while in the daytime only the lower frequencies would arrive from long-distance sources.

The Receiver Problem.

Before the commencement of transatlantic telephony measurements showed that the optimum wave-length lay between 5,000 and 6,000 metres, having regard to the production of the best circuit conditions for the time of day when its commercial use is greatest. The signal consists of a single side band, the carrier (58.5 kilocycles), and the other side band not being transmitted. The side band is also subjected to a certain amount of filtering before transmission, and we are left to deal with high frequencies corresponding, after detection, to the voice range extending from 400 to 2,800 cycles; frequencies below 400 and above 2,800 are not essential to intelligibility, though they add to the naturalness of the speech. The frequencies below 400 demand a relatively much larger amount of energy than those above 400, and hence their omission allows of the power available being used for the frequencies which carry the intelligibility, without making so much demand on power; further, cutting off the edges of the band in this manner reduces the exposure to atmospherics at the receiving end. The suppression of the carrier and one side band also saves a large amount of energy and, at the same time, reduces the exposure to atmospherics.

The receiver designed by the Post Office is of the single detection type; the American receiver employs the double detection principle. There is no essential difference in the results, but nearly all the filtering is effected at 60 kilocycles. The design of filters for high frequencies is difficult, and assistance is obtained in cutting off the edges of the band sharply by the employment of low-frequency filters at a later stage in the receiver. Before the first amplifying valve are low-pass and high-pass filters in tandem, the equivalent of a band-pass filter, and the cut-off at 500 cycles on either side of the band is about 40 transmission units (T.U.). The filter is followed by two amplifying stages which have band filters consisting of two simple circuits coupled together, giving the well-known double-humped curve. Further amplifying stages, having potentiometer control, follow the band filters, then the local carrier is inserted before the detector, following which is a low-frequency low-pass filter and a high-pass filter and further low-frequency amplification with potentiometer control. The overall frequency characteristic curve of the complete receiver approximates to a rectangle with the top nearly, but not quite, flat. The available overall amplification is about 100 T.U. and an output of +15 T.U. above 1 milliwatt can be taken without distortion.

Directive Reception with Wave Antenna.

Having done all that is possible at the receiver to reduce its exposure to atmospherics, the next step is directive reception, transatlantic service being favoured by most of the atmospherics coming from the sector opposite to that from which the signal arrives.

The wave antenna, as used at Cupar, consists of two parallel wires carried on ordinary telegraph poles a distance of just over three miles, which is one wave-length. The antenna picks up the horizontal component of the electric field passing over it, which gives rise, by summation, to a current in the wires which is greatest at the end opposite to that from which the signal arrives. A transformer is placed at this point to transfer the current to the two wires, considered as a transmission line, which carry the current back to the near end where the receiver is connected. At the receiver a certain amount of the wire-to-earth current can be combined with the current from the transmission line to produce zero reception at a selected angle in the back sector, a process known as compensation. One such system constitutes a wave antenna, and combinations of such systems, spaced apart at a distance of 0.62 wave-length, are used to give additional directivity. The wave antennæ are properly terminated at each end to avoid reflections, and the currents are carried from the wave antennæ to the receiving hut by means of transmission lines, precautions being taken to avoid cross-talk between the various lines.

The directive properties of the wave antenna, and the amount of signal, depend to a large degree on the tilt of the electric waves, as it is designed to utilise the horizontal component of the electric field. So far, we have built three systems of

wave antennæ, at Chedzoy (Somerset), Wroughton (Wilts), and Cupar (Fife), and the tilts obtained were 0.1 deg., 0.7 deg., and 1.0 deg., respectively, against between 2 deg. and 3 deg. in America; the differences are probably due to the nature of the soil. At Chedzoy the soil is swampy, at Wroughton the ground-level is high with a chalk subsoil close to the surface, and at Cupar the subsoil is sandstone. The lack of tilt leads to the vertical effects of the antennæ becoming large relatively to the desired horizontal effects and tends to reduce the directivity of the system; that is to say, it may be regarded as a rather long antenna which picks up the field by virtue of its height above ground, whereas the horizontal effect is not directly dependent upon the height above ground. Undulations in the ground tend to have a bad effect on a system of small tilt, and it becomes difficult to build several antennæ with the same electrical results, leading again to loss of directivity when the antennæ are combined. The two antennæ so far completed are not exactly alike, which renders their combination into a still more refined directive system less perfect than it should be, but this statement does not exclude the fact that excellent results are obtained at Cupar, the improvement over ordinary frame reception being most marked. Experiments are, however, being made at the present time with other systems of directive reception which do not depend essentially upon the tilt of the wave front.

In order that the wave antennæ shall behave alike for all frequencies in the band used for the telephony service, it is necessary to keep the resistance and reactance components flat over the frequency band by proper termination of the lines by transformers so as to avoid reflections on the system.

Antenna Arrays.

Directive systems depending on the distribution of antenna systems in space with prearranged phase relations were invented in the early days. Two of the many possible diagrams prominently represent the maximum amount of directivity to be obtained with the simplest possible arrangements. Fig. 1 represents the result of spacing two vertical aerials ½ wave-length apart and combining them with a phase difference of 90 deg., the result being nearly a cardioid diagram, and the combination is extremely useful for producing zero reception at the angle opposite the signal; in fact, it forms the basis of the so-called reflector in the Marconi "beam" antenna (the "staggered" arrangement). Fig. 2 is the result of combining with equal phases two vertical antennæ at a distance of 0.6 wave-length apart on a line at right angles to the signal, this distance apart being chosen as giving the maximum reduction of area from the original circle diagram of each vertical aerial (the "broadside" arrangement).

With the broadside combination of two antenna systems of fig. 2 the reduction of area is so large that where a number of antennæ are to be combined it is better to combine them in pairs and then to combine the pairs again in pairs rather than employ the plain paralleling of the ordinary antenna array. Fig. 3 shows this pyramid combination of antenna systems: each combination of a pair multiplies the diagram of the individuals of the pair by fig. 2, so that we very quickly get a very narrow diagram. The units A, B, C and D may each consist, for example, of two frame aerials staggered ¼ wave-length apart with 90 deg. phase difference, and then the final combination (*k*) is the figure-of-eight diagram of the frame aerial multiplied by fig. 1, and then several times by fig. 2, according to the number of combinations; (*k*) utilises the energy of the several antennæ in the proportion A+3B+3C+D, so that by combining the antennæ in parallel in this proportion we shall achieve the same result as the pyramidal formation. At Cupar the ratio of energy supplied by the middle antenna to that from the outside antennæ is adjustable to meet particular conditions of atmospheric distribution.

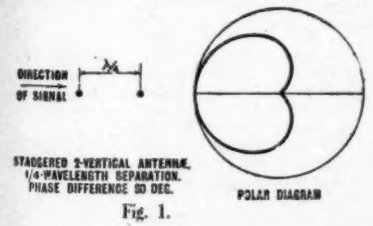


Fig. 1.

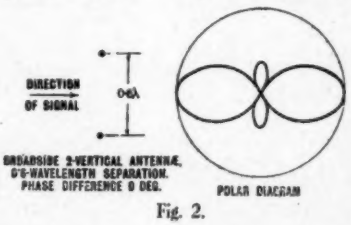


Fig. 2.

In view of the difficulty with regard to the small tilt of the wave front in this country, we are at present engaged on experiments with combinations of frames and vertical aerials, for which calculations indicate marked directive effects. The success of such combinations depends, however, on very great care being exercised in making all the elements of the combination exactly alike, not only the amplitude, but also the phase at every frequency within the band of reception; also for telephony reception there must be no undue attenuation of signals at the edges of the band owing to the tuning of the circuits being too sharp.

No means are at present known of obtaining extreme directivity by a system which operates only at a single point, and it is necessary to extend the operation over an area which is large compared with the wave-length upon which we wish to operate. The systems described have their maximum directivity in the horizontal plane and are therefore suitable for medium and long waves, which arrive horizontally in most cases.

A Leaf Diagram.

A further development is at present the subject of trials. When a frame is combined with a vertical aerial the currents in the frame from two directions 180 deg. apart are also 180 deg. apart in phase; this property, when combined with the currents in the vertical aerial with 90 deg. phase difference, gives zero in one direction and maximum of double strength in the opposite direction characteristic of the cardioid diagram. Now it is possible, by doubling the frequency in the receiver and by other means, to arrange that the frame gives a figure-of-eight diagram with both halves having the same phase, instead of being opposite in phase, and if such a system is combined with a vertical antenna, still with 90 deg. phase displacement, in such a way that the frame currents are subtracted from the circle diagram of the vertical antenna, we are left with a narrow polar "leaf" diagram (fig. 4), and such a system may be employed as the unit in an antenna array, the narrowness of the unit diagram being reflected in the final diagram obtained from the antenna array.

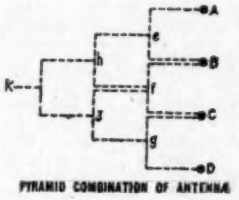


Fig. 3.

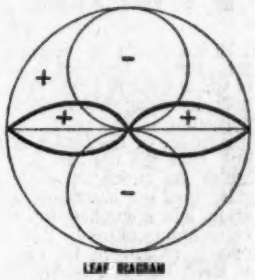


Fig. 4.

When it is necessary to add a local heterodyne before the rectification process, as in the case of single side-band telephony, one-half of the diagram, from 180 deg. to 360 deg., for example, will be the perfect leaf diagram, while the other half, 0 deg. to 180 deg., will be imperfect, the degree of imperfection depending upon the relation of the strength of the local heterodyne to the strength of the atmospherics. This is because the use of the heterodyne produces in the rectification process a phase relation in the beat frequency which is dependent upon the phase of the carrier frequency, so that if two identical carrier frequencies are out of phase by 180 deg. the heterodyne notes will be out of phase by the same amount. When telegraphy is concerned, however, we may in the first place use the rectification process to produce a second harmonic, which can be heterodyned to give the audible signal. This removes the heterodyne to the point after combination has taken place, and no difficulty due to the use of the heterodyne ensues. With single side-band telephony the use of the second harmonic for adding the local heterodyne would cause distortion.

The use of the second harmonic in the receiver brings with it one advantage, that the spacing of the aerial systems in an antenna array may be halved, the directivity being the same as with the more extensive array used on the fundamental wave. Having doubled the frequency in the receiver we are virtually dealing with a signal of half the wave-length, and the optimum antenna spacings should therefore be halved to obtain the same directivity. This plan may be extended to the use of higher harmonics than the second, and it offers a means of obtaining sharp directivity in a smaller area of ground. At first sight the reception of ordinary telephony on the second harmonic would appear to suffer from lack of quality, but the modulating frequencies on the fundamental are carried through to the harmonic unimpaired, and practical tests show that the quality is unaffected by the small quantity of harmonics and combination tones which are generated in rectification.

Conclusion.

The protection of wireless apparatus against the effect of atmospherics has reached a limit set by the necessity of ensuring the intelligibility of the signal, and the use of directive reception offers at present the only means of defence which still has openings for improvement.

The Australian Electrical Exposition.

Among the British companies which exhibited at the Australian Electrical Exposition held in Melbourne during September were W. T. Henley's Telegraph Works Co., Ltd., and the Edison-Swan Electric Co., Ltd.

The Theory of Chromium Plating.

A new theory of the electrodeposition of chromium is advanced, in addition to the three which have already been suggested to account for the working of the chromium bath.

(*Abstract of Paper presented to the* ELECTROPLATERS' AND DEPOSITORS' TECHNICAL SOCIETY.)

AT the 20th meeting of the Society in London on November 9th, Mr. E. A. Ollard, A.R.C.S., A.I.C., presented a paper in which a new theory of the electrodeposition of chromium was advanced.

A special invitation had been extended to the members of the Faraday Society and the London section of the Institute of Metals, to which there was a gratifying response.

Mr. S. Field, A.R.C.S., president, occupied the chair.

Existing Theories.

In the course of his remarks, the author said that, so far, three theories had been put forward to account for the working of the chromium bath. The first of them seemed to be chiefly held by American workers, and was to the effect that the deposition of the chromium took place because of the small percentage of chromium sulphate (or other salt) in the bath, and that the chromic acid functioned as a reservoir from which the chromium could be drawn; they appeared to consider that the chromium sulphate electrolysed, to give chromium and a sulphate ion that reacted with the chromic acid, regenerating chromic sulphate. As it stood, that theory was open to objections, the chief being that there was no evidence to show that a sulphate ion would react with chromic acid, or, if it did, that it would form chromic sulphate, while the theory did not make it clear why better results should not be expected from chromic salts alone.

Dr. Liebreich studied the current-voltage curves of a platinum cathode in chromic-acid solutions and came to the conclusion that the deposits of chromium took place in steps, from the chromic acid itself, the hexavalent chromium being reduced by the current, first, to the trivalent, then to the divalent step, and finally to the metal. His theory, however, did not explain why pure chromic acid should not also give deposits of chromium, or the function of the addition of other acids: but he had produced a great deal of evidence to show that divalent chromium compounds were formed prior to the deposition of the metal.

Dr. Muller had endeavoured to explain the action of the sulphuric acid by a complicated theory of colloidal diaphragms: he suggested that the chromic acid was reduced at the cathode by the nascent hydrogen, but that the reaction was stopped immediately by the formation of a semi-permeable membrane of chromic chromate produced from the reduction products, allowing only hydrogen to pass through it. He further suggested that the addition of another acid modified the diaphragm and allowed the reaction to proceed.

The New Theory.

From conductivity tests, potentiometric measurements, migration tests, and chemical analysis which had been made, it was considered that the solution must consist essentially of the following constituents, in order that chromium might be deposited from it:—

1. Bichromic acid	Usually in fairly large quantities, but might be reduced almost to zero.
2. Bichromate of chromium $Cr_2(Cr_2O_7)_3$	From nearly zero to a very large percentage, varying inversely as the amount of bichromic acid.
3. A substance that would give another anion, such as sulphuric acid, or a sulphate	A small quantity only, which had to be very carefully controlled, and varied with the type of bath used and the material itself.
4. A complex colloidal compound of chromium of type $Cr_2O_3 \times CrO_3$, where x was low	Colloids of this description were found, but did not appear to be present in large quantities, and there was no evidence that they were beneficial.

The first two constituents were obtained by dissolving chromic trioxide in water and its reduction to the desired degree by a convenient method. The third constituent was carefully added in the required amounts, although in some cases part of it might be present as an impurity in the chromic trioxide, and must be allowed for. The existence of the fourth constituent was doubtful, but, if present, it might either be formed during the reduction of the chromium trioxide, or by subsequent electrolysis. It was by no means unlikely that the last suggestion was correct, and it was found that colloids could be experimentally produced in that way.

It was not considered possible that in a bath of that nature any divalent material could exist in the bulk of the solution, while at rest. The composition of the solution must, therefore, be considered as being bichromic acid and chromic bichromate, together with a small quantity of chromic sulphate (or other salt); the concentration of the trivalent ions would be governed by the latter constituent, since the chromic bichromate as shown above ionised only slightly and would, therefore, serve as a buffer substance.

From a careful consideration of all the data available the mechanism of the reaction was considered to be as follows:— In the body of the solution, trivalent chromium compounds (usually the sulphate) ionised to give a trivalent ion. When current was passed, the bichromic acid functioned as a conducting material and the chromic ion was carried to the cathode; the bichromic acid would be electrolysed, forming oxygen and hydrogen, while the chromic salt would give a chromic ion at the cathode and the ion of the corresponding radical at the anode, which would react with the chromic bichromate, reforming the salt and bichromic acid. The chromic ion would be reduced at the cathode, forming, first, a chromous ion, and then the metal; some of the chromous ions formed might, however, escape from the cathode layer, reacting with the bichromic acid to form further quantities of the chromic bichromate. Thus, the bichromic acid formed the conducting material and regulated the acidity, the chromic bichromate formed a buffer substance and reduced acidity, and the chromic salt provided the supply of chromic ions from which the deposit of the metal took place. Some colloidal matter might be formed on the cathode and might effect the structure of the deposit, but it did not appear that there was any great quantity of such material in the body of the solution.

Discussion.

An interesting discussion followed, in which various objections to the theory were put forward.

The PRESIDENT, after congratulating Mr. Ollard on his paper, pointed out that the experimental work had been carried out with a solution containing 600 gms. chromic acid per litre, whereas that employed in practice contained 250 gms. Presumably, the time required to produce the "complexes" and to reduce the conductance would be thus shortened. Also, why could they not use more than 3 gms. chromic sulphate per litre of solution?

Mr. WERNICK (secretary) compared the theory advanced with those put forward by Sargent, Leibreich and Muller, and said the great value of Muller's theory lay in the conception of a diaphragm or film at the cathode. This was tangibly formed and gave a great deal of trouble in practice. How was this accounted for in Mr. Ollard's theory?

Mr. D. J. MACNAUGHTON referred to the fact that the chromium dichromate which Mr. Ollard considered was essential in the bath, had definitely been stated to be not only unnecessary, but positively deleterious by Haring, of the American Bureau of Standards. He thought Muller's theory had not been properly considered.

Mr. G. E. GARDAM said the theory did not explain why an excess of chromic sulphate interfered with the working of the bath; while, again, a *small* amount of chromic acid present should be capable of resulting in a deposit.

Mr. L. WRIGHT said the hydrogen content of the bath was an important factor. With regard to colloids, it was quite possible to obtain a deposit without using a colloid, while the latter definitely went to the *anode* by cataphoresis.

Mr. Ollard then replied to the discussion at length, and on the motion of Mr. D. Macdonald, seconded by Mr. W. James, was accorded a hearty vote of thanks.

The annual general meeting will be held on November 30th, at Northampton Polytechnic Institute, when Mr. S. Field, A.R.C.S., will deliver his presidential address.

Electric Water Heating in France.

Under the auspices of a number of French electrical associations, a series of tests of electric water boilers was recently carried out at the Laboratoire Centrale d'Electricité in Paris. Such apparatus is usually used at night in order to take advantage of the lower off-peak charges for electricity prevailing in France and also to provide ample supplies of hot water in the early morning. An automatic device is also generally provided to switch off the power when the desired temperature of the water is attained, or when the hour is reached at which the higher tariff commences. Fifteen different boilers ranging in capacity from 6½ to 44 gals. were tested and the report states that all were designed to give full satisfaction to users. The efficiency ranged from 89 to 92 per cent. for non-pressure boilers, and from 91 to 95 per cent. for the pressure type. Moreover, the average percentage of hot water supplied, relative to the boiler content capacity, before the temperature of the water drops from 5 to 10 per cent. below maximum, was 75 per cent. in the case of small boilers, 85 per cent. in the case of those of medium size, and 95 per cent. and over in the case of large boilers.

Assisted Wiring Schemes.

The Third E.D.A. Conference.

MR. R. P. SLOAN (chairman and managing director of the Newcastle-on-Tyne Electric Supply Co., Ltd.) presided at an Electrical Development Association Conference, held in London on November 18th, when Mr. S. E. Fedden (city electrical engineer, Sheffield) read a paper on "Recent Progress in Assisted Wiring, Hire and Hire-Purchase Schemes."

Mr. FEDDEN, after commenting on the fact that ever since 1899 the Sheffield Corporation had exercised powers in connection with the installation and selling of electrical apparatus, said that, with the exception of a limited scheme for the hiring of motors, the whole of the business up to comparatively recent years had been by means of direct sales. Within the last few years, however, there had been a growing demand for hire-purchase schemes for the installation of wiring and fittings. To meet this a rental scheme was introduced in 1922 whereby the Corporation wired up to 10 points in a house at a rental of one shilling per quarter per light. A pure rental scheme, however, did not meet with general approval because many people objected to continued payment without eventual possession. There were probably some 70,000 houses in Sheffield with a ratable value of £10 and under, and in 1925 it was decided to adopt an assisted wiring scheme in an effort to induce tenants, although not owners, to install electricity. The scheme only covered streets in which mains were laid, and it did not apply to houses under construction. Moreover, it was limited to houses containing not more than five rooms and requiring not more than five lighting points. The work was carried out by the Corporation, and 40-W gasfilled lamps were supplied free in the first place. The Corporation carried out all necessary repairs, but lamps were renewed by the tenant. The installations remained the property of the Corporation until 800 kWh had been paid for. Shilling- or penny-in-the-slot meters were installed at the option of the consumer, the meters being adjusted to charge at the rate of 8d. per kWh to cover the cost of the installation and energy. After June, 1927, the charge was reduced to 6d. instead of 8d. for the first 800 kWh. Instead of adjusting the meters to take account of the reduction in the charge from 8d. to 6d., the difference was handed in cash to the consumer at each collection from the meters.

Within the first month, 829 applications were received. Up to the end of October this year 9,480 installations had been completed, and applications were being received at the rate of 250 per month. Actually 550 applications were received in October. V.i.r. cables in wood casing were used, and the Electricity Department employed 70 or 80 men continuously upon the work. When considering the scheme, the relative cost of lead-covered cable, wood casing, and v.i.r. cable and c.t.s. cable was investigated, and the figures came out at 14s. 11d. per point for wood casing, 17s. 5d. per point for lead-covered cable, and 16s. 1d. per point for c.t.s. cable. The number of lights installed at the time of the compilation of the statistics was 34,078 in 7,658 houses. The average consumption per installation per annum was 89 kWh; the total quantity of energy supplied per annum was 681,562 kWh; the total cost of installation was £35,928; and the average cost per installation was £4 13s. 10d. An increasing number of consumers were buying their installations outright and adopting the favourable rate offered for the more extensive use of electricity for domestic purposes. Consumers were encouraged to do this, and 800 of these installations had been sold with an allowance made for the sum already paid through the slot meter. Few difficulties had been encountered through change of tenancy, the incoming tenants invariably taking over the installations and completing the payments for it. At the same time, the scheme had been found to be deficient inasmuch as it offered no encouragement to the consumer to use electricity for other purposes than lighting, and in connection with the Corporation housing estates a further scheme had been introduced. The Estates Committee recently decided to equip about 30 houses for the use of electricity throughout, and every one of them had been taken within a very short time. Provision was made for a cooker, wash boiler, kettle, iron, radiator, and immersion heater for the water cylinder, and although it was not yet considered desirable entirely to eliminate coal-consuming devices, these were restricted to the kitchen and one bedroom. The energy charge in the houses was on the basis of 10 per cent. of the ratable value, plus ½d. per kWh. The estimated consumption per house was 3,638 kWh per annum, and the revenue £8 13s. 7d. The hire charges amounted to £2 8s., making a total of £11 1s. 7d. per annum.

The Corporation did not regard it desirable to sell cookers outright at present, as it was necessary for the undertaking to keep in touch with the customer in order to ensure economical and efficient use of the apparatus. The diversity factor of the load was good.

Supply authorities were urged to give the question of water heating careful consideration. Considerable progress had been made in Sheffield in the direction of inserting immersion heaters in the existing cylinders to work in connection with, or entirely apart from, the coal-heated boilers.

Discussion.

Opening the subsequent discussion, the CHAIRMAN said that on the North-East Coast slot meters were installed in very large numbers, but one of the most difficult problems was to obtain a large domestic consumption for purposes other than lighting through the slot meter. The meters did not offer any facilities for two-part tariffs.

Mr. LEADBEATER (Hampstead) asked if any difference was made in terms in Sheffield to the tenant who used his 800 kWh in a short time and the one who spread it over say 10 years. In Hampstead, the consumer under a similar system paid 5½d., or 2d. over the very low rate of 3½d. per kWh for lighting; 7½ per cent. interest was charged on the outstanding balance of the cost. In most cases the tenants completed purchase in seven years. Slot meters were not used, and so far the bad debts had only amounted to £3 2s. 7d. in three years. Steel tubing with v.i.r. cable was used and fittings of a simple character. In the first year the revenue was £22,000, in the second year it was £118,000, and in the third year £187,000. The installation work was done through contractors, and 10 per cent. was added to the contractors' prices. This brought the average cost to 22s. per point, including lamps and fittings.

Mr. RAYNER (Manchester) said that the Manchester Electricity Committee was considering an assisted wiring scheme, and he asked if a limit was placed on five points in Sheffield, or whether the scheme would be made to apply to larger installations. He had been using an immersion heater for three years in an existing cylinder and it had been a great success.

Mr. ROMERO (Salford) asked if Mr. Fedden made any allowance for a considerable proportion of heating and cooking in these small houses, and also whether he considered that if he had introduced a simple hire-purchase scheme instead of putting the extra price on the energy, he would have obtained similar results.

Mr. SHEARS (Hackney) said that in Hackney a fixed charge of 6d. per tenant per week was made, and the rate for energy was 1½d. per kWh, the basis of the system being the completion of the purchase in five years. There was also a shilling-in-the-slot meter scheme which was being actively pushed. At present shades and lamps were not supplied, but that might be altered later. The great difficulty was that the tenants were not the owners, and were constantly leaving their rooms to go elsewhere.

Mr. WATTS (Epsom) said he started an assisted wiring scheme in a district in which he was engineer 26 years ago, and in five years he had got 83 per cent. of the houses in the district on the mains. Recently an assisted wiring scheme had been started in Epsom, and in four months 200 consumers had been connected. He started to put out cookers last March, and 300 were already fitted; they were going out at the rate of one per day. The effect of the cookers had been to increase the total load factor from 25 to 43 per cent., yet the maximum load had only increased 30 per cent. During the past ten weeks the total energy supplied had increased by 80 per cent. Ever since he had been at Epsom he had been strengthening his mains by laying an additional distributor on the other side of the road. He was also putting out separate water heaters.

Mr. RILEY urged the need for lagging water tanks in order to prevent losses which became expensive when current was used at 1d. per kWh.

Mr. PINKNEY (Newcastle-on-Tyne Electric Supply Co.) mentioned that an assisted wiring scheme was in operation in his area, the installation work being carried out by registered contractors. In two years 1,700 new installations had been connected. One of the greatest problems was the supply of lamps. He had known of cases in which when one lamp was supplied free with the installation, this was taken from room to room until it was worn out, and then the installation was not used any more owing to the high price of lamps. He recommended the lamp manufacturers to look into this matter.

Mr. BUCKLE (General Electric Co., Ltd.) considered that the best way to deal with the lamp question was to renew them free, making allowance for this in the charge.

Mr. DAIN (Leyton) said excellent progress was being made in his district with an assisted wiring system. Both hire and hire-purchase were offered but the price of lamps was a great difficulty in a working class district.

Mr. HOWARD disagreed with Mr. Fedden in the use of wood casing, and Mr. HONEY (Croydon) also referred to the lamp difficulty, and said that during the night hours in Croydon electricity could be had at ½d. per kWh for water heating.

Mr. RITCHIE asked how many houses were on one service

at Sheffield, and if the cost of the service was included in the 14s. 11d. per point.

Mr. EDGAR (West Ham) asked if the 800 kWh applied to three, four or five lights, or whether any difference was made according to the number of lamps installed. In West Ham applications were coming in for agreements under an assisted wiring scheme at a more rapid rate than they could be dealt with. The majority of people in his case preferred slot meters.

Mr. FEDDEN, replying to the discussion, said the 800 kWh applied to any number of lights up to five. The number of houses per service depended on how the estate was laid out. C.t.s. cable was used for the service, but it was not included in the 14s. 11d. per point. Energy was supplied for water heating between certain hours at ½d. per kWh for large rooms in clubs, &c., at night. As to wood casing, he maintained that this was the best method of wiring. There were examples which had been in use for 30 years and were as good to-day as when they were first installed. If people would not buy lamps, perhaps the manufacturers would bring down their prices. The development of electric houses, he thought, would result in house-to-house transformers being used again. He knew of one case in which 25 kW was installed in a house; it would be severe on the existing distributors if there were a large number of such houses. The Sheffield scheme might be extended to 10 points later to take in some of the better-class houses.

Parliamentary News.

[By Our Special Parliamentary Reporter.]

A Manhole Accident.

On November 15th, in the House of Lords, Earl RUSSELL called attention to the fatal accident which occurred in an inspection chamber of the Notting Hill Electric Lighting Co. on October 7th, by which three men lost their lives, and asked what steps the Ministry of Transport was taking to prevent such accidents. He said that two workmen were sent to inspect or do some work at a manhole. Although the coroner's jury returned a verdict of "Accidental death," he maintained that responsibility should have been fixed somewhere.

Viscount PEEL, the First Commissioner of Works, replying for the Ministry of Transport, regretted the accident, but said that the view of the Ministry was that the cause of the accident was perfectly clear, and that there was nothing to be gained by an inquiry. The Electricity Commissioners made regulations about inspection chambers, but the manhole could hardly be called an inspection chamber.

Earl RUSSELL suggested that the Electricity Commissioners could make regulations governing any hole in the ground used for electric light purposes for the safety of those who used those places.

Viscount PEEL said he would convey that suggestion to the Commissioners.

Duties of the Electricity Board.

On November 15th, Mr. R. HUDSON asked the Minister of Transport what progress was being made by the Central Electricity Board in the duties assigned to it under the Electricity (Supply) Act of 1926.

Colonel ASHLEY said he had not yet received the first annual report of the Central Electricity Board, and was therefore not in a position to give in detail the information desired. Work had, he understood, already been begun on the Central Scotland Scheme, and tenders for the erection of transmission lines had been received. A second scheme for South-East England had been submitted to the Board by the Electricity Commissioners, and the Board was now considering representations which it had received from authorised undertakers. The Electricity Commissioners expected to transmit to the Board the scheme relating to Central England before the end of the year.

Mr. WELLS asked the Minister of Transport if he would arrange for a public inquiry to be held before an undertaking was controlled in any way by the Board where it could be shown that electricity could be supplied at a lower cost by a local undertaking than the cost estimated by the Electricity Board.

Colonel ASHLEY said he presumed that his hon. friend referred to the powers conferred on the Central Electricity Board by Section 14 of the Electricity (Supply) Act, 1926. If so, he might point out that the question of relative costs, to which he referred, would, under the provisions of those Sections, fall to be determined by arbitration in default of agreement.

A Scottish Electrical Installation.

On November 15th, Mr. J. BROWN asked the Minister of Transport whether he was aware that, while full preparations had been made for many months past for the installation of electric light in the burgh of Cumnock, Ayrshire, the installation had not yet taken place; and whether he would take steps to get the electric light installed at once.

Colonel ASHLEY said that the question of the supply of electricity in Cumnock was one for the Ayrshire Electricity Board, and he had no detailed knowledge of the circumstances referred to. An application from the Board for consent to the erection of overhead lines in various parts of its area was now under consideration, and, as regarded the burgh of Cumnock, he hoped that it might be possible for his decision to be given before long.

Petition Against Poles.

On November 17th, Mr. TREVELYAN asked the Minister of Transport whether he had received a petition, signed by about 250 householders of Corbridge-on-Tyne, against the erection of poles by the Newcastle-upon-Tyne Electric Supply Company in that town; whether his consent was actually obtained before the poles were erected; whether some poles had been erected in streets not included in the Tynedale Electricity Special Order, 1926; and what steps he proposed to take to meet the objections raised.

Colonel ASHLEY said that the answer to the first part of the question was in the affirmative. As regarded the second and third parts, his consent only operated from the date on which it was given and in respect of the routes referred to therein. As regarded the fourth part, he was not in a position to withdraw his consent, which was given after the consent of the Hexham Rural District Council, on whom the right of making representations on behalf of the locality was conferred by the statute, had been received.

Legal.

The Dover Aerial Ropeway.

On November 16th, the Court of Appeal consisting of Lords Justices Scrutton, Sargant and Greer, commenced the hearing of an appeal by the Southern Railway Co., and the East Kent Light Railway Co., against a decision of the Railway and Canal Commission sanctioning the installation of an aerial ropeway between the Tilmanstone Colliery and Dover Harbour. Sir John Simon, K.C., for the appellants, argued that the Commission had no power to sanction such a scheme merely because it was supposed to be to the advantage of the public.

Sir Leslie Scott, K.C., upheld the decision and said that the rights of private property could be over-ridden on terms of fair compensation to the owners.

The hearing was adjourned.

Messrs. Hailwood & Ackroyd, Ltd., Summoned.

The adjourned summonses against Messrs. Hailwood & Ackroyd, Ltd., and their managing director, Mr. E. A. Hailwood, came before Mr. Rooth at the Lambeth Police Court on November 17th. They were charged with incurring expenses on account of the Liberal or Socialist candidates in the Brixton by-election last June without the written authority of their agents. The case arose out of the circulation of leaflets and the touring of motor-vans bearing bands urging the electors to vote against the Conservative candidate.

A further charge arose out of the fact that the leaflets did not bear the name and address of the printer and publisher.

Mr. Roland Oliver, K.C., prosecuting, said that the action was taken under the Representation of the People Act and the Corrupt Practices Act, 1883. The participation of the defendants in the election was due to the alleged failure of the Government to safeguard the glassware industry in which the defendants were engaged. The total expenditure so far as could be ascertained was over £30. The Liberal and Labour agents were called and denied that they gave authority for the expenditure. Evidence relating to the printing of the pamphlets and the touring of the vans was given.

Mr. Comyns Carr, for the defence, submitted that no case of a criminal offence had been established and asked the magistrate to dismiss the charge.

Mr. Rooth decided to commit the defendants for trial at the Central Criminal Court as he did not feel competent to deal with the case.

Alleged Fraudulent Prospectuses.

At the Mansion House on November 17th, Sir Charles Buckworth-Herne-Soame, Bt., Robert G. Harley and Col. Edmund Octavius Eaton again appeared on charges of conspiring together and with others to defraud such persons as might receive prospectuses issued by the Chalk Fuel Power Gas and By-Products Corporation, Ltd., and to obtain money from them by representing that reports which appeared in the prospectuses were true and made by those purporting to have made them.

At the previous hearing (ELECTRICAL REVIEW, November 11th, p. 815) evidence was given by witnesses who had tested the fuel and had reported adversely upon it.

Evidence was now given by the Rev. H. Hooke-Bartram who stated that he had been induced to subscribe for shares by statements in a prospectus issued by the company.

Mr. W. M. Mackay, an analytical chemist, said that the fuel submitted to him for testing was supplied by Messrs. Yeadon, Sons & Co., of Leeds, a reputable firm of high standing.

Mr. G. H. Franklin gave evidence regarding tests which he had made on the fuel. In spite of his adverse reports, statements regarding the efficiency of the fuel were made in the prospectuses and his name was put to them. It was intimated that it would be necessary to cross-examine the witness at length, and the case was further adjourned.

Norton Wireless Co., Ltd.

MR. JUSTICE ROMER, in the Companies' Winding-up Court, on November 15th, made an order for the compulsory liquidation of the Norton Wireless Co., Ltd., Norton Folgate, London, E.C., on the petition of Impex Electrical, Ltd., Leytonstone, E., wireless accessory makers, who recently obtained judgment against the respondent company in a passing-off action.

MR. WAITE, for the petitioners, said that execution had been levied without result. The respondent company was not represented.

Imprisonment for Fraud.

FOR a series of extensive frauds on his employer, an electrical engineer, by obtaining commission on fictitious orders, Richard Pearn was sentenced to six months' imprisonment by the Plymouth magistrates on November 18th.

Workmen's Compensation Case.

AN application for the review of a compensation award was made at Nelson County Court on November 17th, by Colne Corporation, the respondent being Garratt Doyle, a tramway employé.

Doyle was repairing overhead wires on October 4th, 1926, when he touched a live wire. The electricity passed through his body. He continued at work, but had to see a doctor. Since then he had never worked, and under an arbitration award had received 30s. a week. It was stated that Doyle was a good workman, but medical opinion was that he was obsessed with the fact that he narrowly escaped death. So long as he remained in that condition he would not be fit for work. The Judge adjourned the case *sine die* on condition that respondent undertook light regular work.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings taken.

1926.

16,213. "Electric telephones, loud-speakers, and the like." B. Jirotka, June 29th, 1925. (254,339.)

16,388. "Boxes, particularly boxes for radio sets." J. A. Bower. June 29th, 1926. (279,583.)

16,493. "Compensating sea-earths for submarine telegraphy." H. Tinsley and D. C. Gall. June 30th, 1926. (279,534.)

16,497. "Modulating arrangements for high-frequency waves." D. O'B. T. McAteer and W. A. Beatty. July 1st, 1926. (279,535.)

16,602. "Magneto electric machines." R. B. North and A. Massey-Allen. July 26th, 1926. (Cognate application 24,805/26.) (279,540.)

16,632. "Electric advertising devices." International Law Agency. July 25th, 1925. (255,903.)

16,770. "Magnetic alloys and their application in the manufacture of telegraphic and telephonic cables." W. S. Smith and H. J. Garnett. July 27th, 1926. (279,549.)

16,928. "Electrical remote-control systems." A. Reyrolle & Co., Ltd., and L. H. Leeson. July 29th, 1926. (279,556.)

16,951. "Magneto-electric machines." R. B. North and A. Massey-Allen. July 29th, 1926. (279,559.)

19,000. "Automatic and semi-automatic telephone circuits." Standard Telephones & Cables, Ltd., A. M. Searle, E. P. G. Wright and J. H. E. Baker. July 30th, 1926. (279,565.)

19,061. "Automatic and semi-automatic telephone circuits." Standard Telephones & Cables, Ltd., A. M. Searle, E. P. G. Wright and J. H. E. Baker. July 30th, 1926. (279,566.)

19,084. "Process for manufacturing electrical resistance bodies and machine for carrying out this process." Dr. S. Loewe. August 1st, 1925. (256,264.)

19,838. "Thermionic valves." Edison Swan Electric Co., Ltd., and T. W. Price. August 11th, 1926. (279,576.)

20,594. "Radio receiving sets of the supersonic kind." Igranic Electric Co., Ltd., and G. A. Mower. August 20th, 1926. (279,580.)

20,804. "Systems for controlling apparatus electrically from a remote point." R. W. James (Holmes Navigating Apparatus Co., Inc.). August 23rd, 1926. (279,581.)

21,316. "Loud speakers." W. G. Gale. August 30th, 1926. (279,587.)

21,843. "Arrangements for measuring electrical quantities." Siemens Bros. & Co., Ltd., and W. H. Grinsted. September 4th, 1926. (279,590.)

22,619. "Mounting piezo-electric crystals." A. Hinderlich. September 14th, 1926. (279,595.)

22,624. "Sound-boxes of sound-reproducing machines." F. M. Winter. September 14th, 1926. (279,596.)

23,238. "Electrical heating device for heating water in domestic hot-water cylinders, radiators, or the like." L. F. Whitehouse and S. Culpan. September 21st, 1926. (279,600.)

25,154. "Electroplating apparatus." J. G. Newey and C. B. Jerred. October 9th, 1926. (279,616.)

26,766. "Loud-speaker horn." E. C. R. Marks (J. Brüning & Sohn Akt.-Ges.). October 26th, 1926. (279,631.)

26,959. "Apparatus for operating electric lifts." Etchells, Congdon and Muir, Ltd., and F. Muir. October 28th, 1926. (279,634.)

27,323. "Electric protective apparatus." British Thomson-Houston Co., Ltd., S. M. Lejeune and H. S. Petch. November 1st, 1926. (279,638.)

27,677. "Electric incandescent lamps." General Electric Co., Ltd., and R. J. Kaula. November 4th, 1926. (279,641.)

28,730. "Systems of electric transmission." British Thomson-Houston Co., Ltd. November 27th, 1925. (262,085.)

29,254. "Eye protector for electric welding and method of employing same." F. Lilienthal. November 21st, 1925. (261,766.)

29,967. "Electric lamp caps." General Electric Co., Ltd., G. H. Ide and R. J. Kaula. November 26th, 1926. (279,654.)

30,275. "Starting of motor convertors." English Electric Co., Ltd., and G. Schroeder. November 30th, 1926. (279,659.)

32,422. "Warning device for use in connection with ships' telegraphs." E. C. Lynd. December 22nd, 1926. (279,674.)

1927.

189. "Method of obtaining an electric arc from an alternating-current supply for therapeutic and other purposes and of improving the steady sustainment of a direct-current arc." G. G. Blake. January 4th, 1927. (279,680.)

1,341. "Electric cables." Callender's Cable & Construction Co., Ltd., and S. J. Bryce. January 17th, 1927. (279,684.)

2,282. "Machines for winding or covering cables or the like with tape or strip material." F. Krupp Grusonwerk Akt.-Ges. September 11th, 1926. (Addition to 267,091.) (277,286.)

3,095. "Tuning apparatus for radio receivers." Brandes Laboratories, Inc. December 2nd, 1926. (279,689.)

5,860. "Electric protective devices for the discharge of high potentials." British Thomson-Houston Co., Ltd. March 2nd, 1926. (267,129.)

6,332. "Fixation of insulators for electric wires." A. Stemmann. March 8th, 1926. (267,156.)

7,184. "Protective arrangements for electric systems." British Thomson-Houston Co., Ltd. March 18th, 1926. (267,930.)

7,531. "Radio-receiver attachment for telephones." G. F. Mitchell. March 18th, 1927. (279,702.)

7,628. "Direction finders." Telefunken Ges. für Drahtlose Telegraphie. March 20th, 1926. (267,969.)

8,621. "Method of and device for securing contact caps to electric insulators." E. Neumann (trading as E. Neumann-Hochspannungs-Apparate-Fabrik). March 29th, 1926. (268,395.)

8,882. "Electric transformers." British Thomson-Houston Co., Ltd., and H. S. Holbrook. March 31st, 1927. (279,705.)

9,748. "Means for the distant automatic control of a central electric hydraulic station." M. Lorfeuvre. November 10th, 1926. (279,708.)

9,827. "High-tension measuring devices." International General Electric Co., Inc. April 17th, 1926. (269,536.)

10,062. "Wireless receiving apparatus." H. J. J. M. De Regnauld De Bellescize. April 13th, 1926. (269,354.)

10,672. "Electrical connectors." D. T. Campion. April 20th, 1927. (279,714.)

11,139. "Vibratory electroresponsive devices." J. F. Stewart (Allgemeine Elektricitats Ges.). April 26th, 1927. (279,716.)

11,405. "Tuning device for all wireless wavelengths and for all resistances for electrical work." F. D. Winslow. April 29th, 1927. (279,719.)

13,699. "Radio transmission systems." Marconi's Wireless Telegraph Co., Ltd. May 22nd, 1926. (271,510.)

13,708. "Electric induction furnaces." Electric Furnace Co., Ltd. (E. F. Northrup). May 21st, 1927. (279,733.)

14,372. "Apparatus for electrodeposition." International Coperclad Co. August 19th, 1926. (276,306.)

14,971. "Windings for electrical transformers." Metropolitan-Vickers Electrical Co., Ltd. June 7th, 1926. (272,234.)

15,105. "Insulators for high-tension electric currents." F. Berg. June 7th, 1927. (279,738.)

17,032. "Arc welding." British Thomson-Houston Co., Ltd. June 29th, 1926. (273,705.)

17,056. "Arrangement for driving asynchronous motors which have to be run at times with a very low speed." Siemens-Schuckertwerke Ges. July 3rd, 1926. (273,707.)

17,474. "Sparking plugs." E. P. Adam and R. L. Metailler. July 2nd, 1926. (273,740.)

17,896. "Contact breakers for the ignition devices of internal-combustion engines." R. Bosch Akt.-Ges. August 27th, 1926. (276,632.)

19,671. "Electrical contact plugs." R. Hoffmann. July 30th, 1926. (275,225.)

19,717. "Electric motors provided with gearing." W. R. Uggla and A. G. F. Wallgren. August 14th, 1926. (275,956.)

19,817. "Excess-current relays." International General Electric Co., Inc. August 24th, 1926. (276,640.)

20,356. "Electric domestic suction cleaners and polishing machines." International General Electric Co., Inc. August 2nd, 1926. (275,266.)

21,190. "Electric lighting control mechanism." Westinghouse Electric and Manufacturing Co. August 24th, 1926. (276,655.)

22,561. "X-ray photography." Dr. F. Simon. August 25th, 1926. (276,678.)

23,421. "Electric high-frequency communication systems." Westinghouse Electric & Manufacturing Co. September 13th, 1926. (277,929.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from November 16th:—

BI (lettering and design). No. 478,924. Class 1. Varnishes for use on metal work and soldering paste.—British Insulated Cables, Ltd.

Robur. No. 484,677. Class 6. Electric floor-polishing machines and vacuum-cleaning machines.—Heinrich Protti, Vienna. (British representatives: Marks and Clerk, 57-58, Lincoln's Inn Fields, W.C.2.)

Kodigraph. No. 483,732. All goods in Class 8.—Kodak, Ltd.

Donogram. No. 484,639. Class 8. Devices for use in connection with gramophones for converting mechanically-produced vibrations into electrical impulses.—Donotone Loud Speakers, 40, Furnival Street, E.C.4.

Reprovox. No. 484,750. Class 8. Electric batteries and apparatus and parts thereof for radio-telegraphy and telephony.—G. D. Barraclough, 16 and 18, Moult Street, Cross Street, Manchester.

Swiss Electric Railways.

An indication of the traffic increase on the electrified Swiss Federal Railways is given by the fact that for the nine months ended September last the accounts showed a revenue increase of some fifteen million francs, the total receipts for traffic amounting to over 290 million francs. The running expenses were two million francs less than for the corresponding period of 1926, so that great hopes are held out for a favourable final balance-sheet at the end of the year. To cope with the ever-increasing traffic the Swiss Federal Railways are setting aside 300,000 fr. for the preliminary work of enlarging the station at Berne. Plans of extension have been drawn up and will shortly be submitted to the Board of Management.

A committee meeting of the two Federal Chambers has been held at Berne to discuss the loan of 3½ million francs for the electrification of the line from Berne to Neuchatel. Members of the Committee and experts visited the stations and installations, and a second meeting was held at Anet. No opposition was made to the project.

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

AMPTHILL (Beds.).—Housing scheme (44), for the R.D.C.; surveyor.

ASHBY-DE-LA-ZOUCH.—Electric light installation, institution, for the B.G.; G. Farmer, clerk.

ASHFORD.—Central school; Kent Education Committee.

BISHOPSWORTH (Bristol).—Church (£2,000), for the Congregational trustees; secretary.

BLAYDON.—Hospital extension (£6,000); Joint Hospital Board and Durham C.C.

BOURNEMOUTH.—New schools, Malvern Road; St. Walburga's school managers. Promenade extension (£40,000); borough engineer.

BRECON.—Installation of electric light, institution, for the B.G.; the clerk.

BRIERLEY HILL.—Electric light installation, Mill Street Schools, for Staffs. E.C.; director of education, Stafford.

BROMLEY.—County school for girls; Kent Education Committee.

CHINGFORD (Essex).—Block of 10 shops, Chingford Mount Road, for Peachey & Co.

CLAYBURY (Essex).—Nurses' home, Asylum (£23,500); L.C.C. architect.

CLECKHEATON.—Schools, Heaton Avenue, with electrical work, for Spenborough E.C.; R. Castle & Sons, architects, Midland Bank Chambers.

CREWE.—Additional 34 houses, Underwood Lane, for the T.C.; borough surveyor. Houses (56), for the T.C.; D. Cooper, builder, Warrington.

CROMPTON (Lancs.).—Housing scheme (50), for the U.D.C.; surveyor.

DARTFORD.—Reconstruction, Long Reach Hospital; W. H. Barber & Son, quantity surveyors for M.A.B. Additions, Baltic Saw Mills; J. Sharp & Sons, Ltd.

DEWSBURY.—Extension of retort house, with new coal handling plant; H. L. Bateman, gas engineer and manager, Gasworks, Savile Town.

DROITWICH.—Central school; director of education, Worcestershire Education Authority.

DUDLEY.—Two machine shops, Burnt Tree works; Ewarts, Ltd. Technical college, Priory Estate; Education Committee.

DURHAM.—Extensions, County Mental Hospital; Durham C.C.

EDINBURGH.—44 houses for Corporation; city architect.

FAREHAM.—Senior school for girls, for Hants E.C.; director of education, The Castle, Winchester.

FARNBOROUGH (Hants.).—Additional housing scheme (40), for the U.D.C.; surveyor.

GLASGOW.—Greyhound track and stands at Paisley Road West, for Glasgow Greyhound Racecourse, Ltd.; the secretary, 38, Bath Street. 700 houses for Western Heritable Investment Co. (electric lighting); the secretary. Shops for Corporation at Hamiltonhill; city architect.

GLOUCESTER.—Rebuilding premises, for the Bon Marché, Ltd.

GREAT WARLEY (Essex).—Film factory, Selo Works, for Selo, Ltd.

HERTFORD.—Grammar school; J. W. Fisher, architect, Wellingborough.

HITCHIN.—Extensions, Girls' Grammar School; governors.

HORBURY BRIDGE (Yorks.).—Reinstatement of Albion Mills, for George Harrop & Sons, Ltd., woollen manufacturers (many thousand pounds).

HOUGHALL.—Farm buildings (£11,000); Durham C.C.

HULL.—Welding sheds, Technical College; H. Astley Cooper, quantity surveyor for Education Committee.

ILKESTON.—Additions, Hall, Hallan Fields Road; Stanton Ironworks Co.

LEEK.—Housing scheme (110), Station Street and Morley Street; W. E. Beacham, surveyor to U.D.C., Town Hall.

LONDON (E.C.).—Buildings, Little Britain; Edwin Williams and Herbert Eyatt Davies.

(St. Pancras, N.W.).—Weights and measures offices, Euston Road (£23,500); Allen Fairhead & Sons, Ltd., Enfield.

(Bermondsey, S.E.).—Town Hall extensions, Spa Road (£20,000); borough engineer. Reconstruction, South Bermondsey Station on new site; Southern Railway Co., Ltd.

LONDON.—*Contd.*

(Greenwich, S.E.).—Maternity and child welfare centre, for the T.C.; borough engineer.

(Sidcup, S.E.).—Central school; Kent Education Committee. County school for boys; Kent Education Committee.

(Woolwich, S.E.).—Church, Westbourne Avenue, for the Wesleyan trustees; secretary.

(Balham, S.W.).—100 houses, Bell Estate; John Laing and Son, Ltd. Shops and flats, Upper Tooting Road; Perry and Perry.

(Battersea, S.W.).—Extensions, Battersea Polytechnic (£15,000); governors.

LOWESTOFT.—Warehouse and showroom, Suffolk Road; R. J. Pryce & Co.

LYE.—Additional housing scheme (52), for the U.D.C.; H. E. Folkes, surveyor.

MAIDSTONE.—Headquarters, Knightrider Street, for the Maidstone and District Motor Services, Ltd.

MALVERN.—Concert hall, pump room, and opera house and theatre, for the U.D.C.; A. V. Rowe, architect, 38, Foregate Street, Worcester.

MANCHESTER.—Motor-'bus garage, Queen's Road Car Depôt; city architect, Town Hall.

MILFORD-ON-SEA (Hants).—Cottage hospital (£6,000); Mr. Pole, architect.

MOTHERWELL.—Additions to silk factory, Factory Road, for Anderson & Robertson's; the manager.

NONINGTON.—Central school; Kent Education Committee.

NORTHAMPTON.—Additional 34 houses, Abington, for the T.C.; borough surveyor.

OLDBURY.—Additional housing scheme (60), for the U.D.C.; W. Greenwood, surveyor.

PAISLEY.—Motor tire factory at Inchinnan; Taylor & Melville, Great Clyde Street.

PETERBOROUGH.—Children's ward, Memorial Hospital (£10,000); Wallace Marchment, architect.

PLYMPTON ST. MARY.—20 houses (electric lighting) for the R.D.C.

ROTHERHAM.—Joint mental hospital; Rotherham, Sheffield, Barnsley and Doncaster Corporations. Sewage disposal works, with pumping station, pump houses, &c., Dalton and Thrybergh, for the R.D.C.; C. O. Rawstron, engineer, Grove Road, Moorgate.

RUSKINGTON.—Electric lighting at Parish Church; the rector.

ST. ALBANS.—Mental deficiency institution, Hixberry, for Herts C.C.; H. Carter Pegg, architect.

SAWSTON.—College (£7,200), for Cambs. E.C.; director of education, Cambridge.

SEAHAM HARBOUR.—School (440 places), for Durham E.C.; F. Willey, architect, 34, Old Elvet, Durham.

SHAW (near Oldham).—Housing scheme (50); surveyor to U.D.C.

SHEFFIELD.—Improvements, Nether Edge Hospital; Board of Guardians.

SKEGBY.—Housing scheme (30), for the R.D.C.; L. Dodsley, architect, Portland Square, Sutton-in-Ashfield.

SOUTHPORT.—Cinema, Cambridge Road and Preston New Road, for Dr. T. Clarke. Shops, houses, flats, bank premises, garages, &c., Roe Lane, for P. Sutton.

STALYBRIDGE.—Extensions, Quarry Street Mills; Robert Platt, Ltd.

SUNDERLAND.—Extensions, Sunderland and Durham Royal Institute for Blind (£8,000); governors.

TAMWORTH.—Electric light installation, Girls' High School, for Staffs. E.C.; Moffett, Rosher & Mann, consulting engineers, Union Chambers, Temple Row, Birmingham.

WAKEFIELD.—Joint mental hospital; city engineer.

WALSALL.—Extension of Great Barr Defective Colony (£140,000); clerk to the Walsall and West Bromwich Unions Joint Committee.

WANTAGE.—School (240 places), for Berks. E.C.; director of education, Reading.

WATFORD.—Public library (£17,966), for the T.C.; C. Brightman & Son, Ltd., builders.

WESTON-SUPER-MARE.—Extensions, Richmond Street, for the Commercial Cable Co.; Ball & Pope, architects, 30, West Street.

WIGAN.—Conversion of Poolstock Mill into artificial silk fabric factory, for a syndicate; John Livesey.

WOKING.—Additional housing scheme (200), for the U.D.C.; surveyor.